CATLIN
ENGINEERS and SCIENTISTS

Post Office Box 10279
Wilmington, NC 28404-0279
Telephone: (910) 452-5861
Fax: (910) 452-7563

February 12, 2004

Commander
Naval Facilities Engineering Command
Atlantic Division
6506 Hampton Blvd., Bldg. A, Room 1124
Norfolk, Virginia 23508

Attention: EV23JC, Mr. John D. Conway, P.G.

Re: **FINAL Remedial Action Optimization & Revised Corrective Action Plan**
1613
Marine Corps Base
Camp Lejeune, North Carolina

Navy Contract No. N62470-01-D-3009
Delivery Order No. 0079
CATLIN Project No. 203-063

Dear Mr. Conway:

CATLIN Engineers and Scientists (CATLIN) are pleased to submit the FINAL Remedial Action Optimization & Revised Corrective Action Plan for the above referenced site. We have reviewed the comments to the referenced draft report and offer the following responses to the comments/concerns offered by Ms. Hall.

Executive Summary

- **1st para - Delete "as" after "make revisions."**

  Acknowledge. Text has been changed as suggested.

- **2nd para - Insert commas in third sentence before and after "if applicable"**

  Acknowledge. Text has been changed as suggested.

- **Third para and rest of document - System startup in October 1998.**

  Acknowledge. Text has been changed as suggested.

- **4th para - End sentence after "system was expanded."**

  Acknowledge. Text has been changed as suggested.

- **5th para - Change "in forced" to "enforced"; Insert comma after "CAP" in third sentence.**

  Acknowledge. Text has been changed as suggested.

- **5th sentence may better read if reworded: "With the implementation of these new regulations and guidelines, we propose using the GCLs and residential MSCCs as the new clean up goals." Also, why residential vice Indus/Commercial?**

  The referenced text has been reworded as follows: "With the implementation of these new regulation and guidelines, we propose using the Gross Contaminant Levels (GCLs) and the Industrial/Commercial Maximum Soil Contaminant Concentrations (MSCCs) as the new "clean up" goals for groundwater and soil, respectively."

  The soil "clean up" goals have been changed to Industrial/Commercial. The Residential wording was originally recommended due to the presence of temporary residences located within 1,500 feet of the project site. Upon further review of the receptor survey, it is our opinion that the Industrial/Commercial classification is more appropriate for this site. The text has been modified accordingly throughout the report.

- **Last para - Last sentence replace "the Notice...requirements" with "applying a land use restriction (LUR)."**

  Acknowledge. Text has been changed as suggested. However, it is our understanding that the intent of the Notice of Residual Petroleum will be required by NCDENR prior to receiving a No Further Action.

General Comments

- **Use Shaw instead of OHM throughout report.**

  OHM and Shaw have been referenced within the report as applicable to the company that performed the referenced tasks. It is our opinion that using the name of Shaw instead of OHM would be confusing to a reader trying to reference previous reports. Therefore, the text has not been changed as suggested.

- **Where do we draw the line in asking for NFA with LURs? As sites with LURs require tracking etc. One day contamination at the sites will go below 2L - what then? Did we determine how long it would be to get to 2L? What's are the benefits of shutting down now vice running a few more years vs. maintaining LURs at the site for eternity?**

  These comments were recently discussed with Ms. Hall during a telephone conversation. It was agreed that it would be recommended that sites with LUR's will be monitored on a regular basis (five years) until such time that the contaminants of concern were below applicable groundwater quality standards. At this time NCDENR could be petitioned for removal of the LURs. It was agreed that the costs associated with preparing the LUR document and monitoring on a five-year basis would be significantly less than continuing operation of the current active remediation system until the 2L GWQS are met. The recommendation of sampling the site after receiving the NFA with LUR's on a five-year basis has been added to the Optimization Recommendations (Section 6.0) and the Implementation (Section 7.0) sections of the report.

Section 2.0

- **3rd para - Delete "that", end sentence after "Jan 1995", and insert "They" before "were located northeast..."**

  Acknowledge. Text has been changed as suggested.

- **5th para - Can't Shaw personnel attest to the fact that product hasn't been detected for the last several years via their gauging/AFVR events log?**

  Acknowledge. CATLIN requested this information from Shaw again on February 3, 2004. As of the preparation of the Final Remedial Action Optimization and Revised Corrective Action Plan, CATLIN has not obtained the operational information of this portion of the system. Therefore, the text has not been modified.

- **6th para - Delete note about OHM Shaw reference and just use Shaw in report.**

  Acknowledge. Note was deleted as suggested. Based on the response to the first bullet within the General Comments above, the locations within the text that reference OHM were not changed to Shaw.

- **7th para - Top of page 3: The first full sentence doesn't agree with what was said in the exec summ about no RBCA analyses were done. This comment also applies throughout the report i.e. 5.3.1, 6.1**

  This comment was recently discussed with Ms. Hall during a telephone conversation. As discussed, limited soil RBCA analyses were performed during the 2000 investigation performed by OHM (MADEP EPH/VPH). CATLIN has changed the text of each referenced section to reflect that the limited soil RBCA analyses were performed in 2000.

Section 3.2

- **1st para - Again, can't Shaw provide documentation that no product in well 6 since a certain date? I would think their gauging data and AFVR logs would document whether or not (and when) product existed.**

  Acknowledge. Please refer to the response to the second bullet comment of Section 2.0 provided above.

- **3rd para - Wrong reference to TT2477**

  Acknowledge. Text has been changed as suggested.

Section 4.1

- **Same comment as above on free product issue**

  Acknowledge. Please refer to the response to the second bullet comment of Section 2.0 provided above.

Section 4.2.2

- **2nd para - Subject verb agreement wrong**

  Acknowledge. Text has been changed as suggested.

Section 4.3

- **Replace "applicable for the reduction of" with "effective in reducing"**

  Acknowledge. Text has been changed as suggested.

Section 5.1

- **1st para - Add "rules" after RBCA**

  Acknowledge. Text has been changed as suggested.

- **Last para - Residential land use? Why not Industrial/Commercial? Because contaminants are below Residential MSCCs? This also applies to 5.2.2.**

  Acknowledge. As previously stated, the text has been changed from Residential Land Use to Industrial/Commercial Land Use throughout the report.

Section 5.2.3

- **Include the newly expanded list.**

  Acknowledge. The following sentence has been added to the paragraph after the second sentence: "The new COCs are provided on the attached Table 2."

Section 5.3.1

- **Same soil comment as above in 2.0**

  Please refer to response to soil comment in Section 2.0.
- **Last para - Per first sentence, where did the previous 2000 reference come from then?**

  As stated in Section 4.1 of the report, the 2000 reference is based on information provided in the 2002 Annual Monitoring Report.

Section 6.1

- **Same soil comment as in 2.0**

  Please refer to response to soil comment in Section 2.0.

Section 6.2

- **2nd sentence modify to read: "Once shut down, the system should be secured to assure that ...."**

  Acknowledge. Text has been changed as suggested.

- **End 3rd sentence after rebound effects. Too many "system shutdowns" in that para.**

  Acknowledge. Text has been changed as suggested.

- **Last para - However unlikely, what happens if contaminants rebound?**

  Acknowledge. The last sentence of this paragraph has been modified as follows: "The results of these four quarters of sampling should be evaluated and, if applicable, a Groundwater Monitoring Report with Site Closure be prepared and submitted to the NCDENR. In the event that groundwater contaminants rebound significantly (greater than the GCLs) then restarting the active remediation system should be considered."

CATLIN Engineers and Scientists appreciate the opportunity to continue to provide services to LANTDIV and the MCB on your environmental projects.

Sincerely,

Jeffery K. Becken, P.E.
CATLIN Project Engineer

Michael E. Mason, P.E.
CATLIN Program Manager

Attachments: Remedial Action Optimization and Revised Corrective Action Plan

cc: Mr. Roger R. Marce, Jr. - Code AQ 135 Contracts (correspondence only)
Commanding General, Attn: Director I&E/EMD/EQB (2 copies)

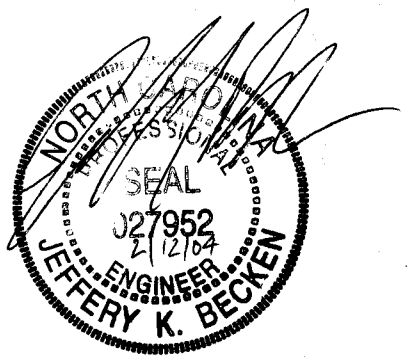
203063_1613_final ltr.doc

REMEDIAL ACTION OPTIMIZATION
&
REVISED CORRECTIVE ACTION PLAN
BUILDING 1613

MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

FEBRUARY 12, 2004

NCDENR Incident No.: 20660
Navy Contract No.: N62470-01-D-3009
Delivery Order No.: 0079
CATLIN Project No.: 203-063



Prepared by:

CATLIN Engineers and Scientists
P.O. Box 10279
Wilmington, North Carolina 28404-0279
(910) 452-5861

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

LIST OF ACRONYMS

2000 Guidelines	Groundwater Section Guidelines for Investigation and Remediation of Soil and Groundwater
2001 Guidelines	Guidelines for Assessment and Corrective Action, North Carolina Underground Storage Tank Section (Effective July 1, 2001)
2L GWQS	NCAC T15A:02L Groundwater Quality Standards
ARO	Asheville Regional Office
AS	Air Sparge
AST	Aboveground Storage Tank
AFVR	Aggressive Fluid Vapor Recovery
BDL	Below Detection Limit
BN	Base/Neutral (extractables)
BNA	Base/Neutral/Acid (extractables)
BQL	Below Quantitation Limit
BLS	Below Land Surface
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CAP	Corrective Action Plan
CATLIN	CATLIN Engineers and Scientists (Formerly RC&A)
CFR	Code of Federal Regulations
Cr	Chromium
CSA	Comprehensive Site Assessment
CNP	Carbon Nitrogen Phosphorous
CPT	Cone Penetrometer Test
COC	Contaminants of Concern
DEM	Division of Environmental Management
DIPE	Diisopropyl Ether
DO	Dissolved Oxygen
DOD	Department of Defense
DPT	Direct Push Technology
DWQ	Division of Water Quality
DWM	Division of Waste Management
DTW	Depth to Water
EAD	Environmental Affairs Department
EDB	Ethylene di-bromide
EMD	Environmental Management Division
EPA	Environmental Protection Agency
EPH	Extractable Petroleum Hydrocarbons
EQB	Environmental Quality Branch
Fe	Iron
FID	Flame Ionization Detector
FOD	Foreign Object Debris
FRO	Fayetteville Regional Office
FT	Feet
GCL	Gross Contaminant Level
GIS	Geographic Information System
GPS	Global Positioning System

Guidelines Vol. I	Groundwater Section Guidelines for Investigation and Remediation of Soil and Groundwater, Volume I, Sources Other Than Petroleum Underground Storage Tanks (May 1998)
Guidelines Vol. II	Groundwater Section Guidelines for Investigation and Remediation of Soil and Groundwater, Volume II, Petroleum Underground Storage Tanks (January 2, 1998)
HDPE	High Density Polyethylene
I/C	Industrial/Commercial
ID	Identification
I&E	Installations and Environment Department
IGWQS	Interim Groundwater Quality Standards
IPE	Isopropyl Ether
LANTDIV	Atlantic Division
LSA	Limited Site Assessment
LUST	Leaking Underground Storage Tank
m-	meta
m	meter
MADEP	Massachusetts Department of Environmental Protection
MCALF	Marine Corps Auxiliary Landing Field
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCCS	Marine Corps Community Services
MCOLF	Marine Corps Outlying Landing Field
MDL	Method Detection Limit
mg/Kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
MRO	Mooresville Regional Office
MSCC	Maximum Soil Contaminant Concentration
MSL	Mean Sea Level
MTBE	Methyl tertiary butyl ether
µg/Kg	Micrograms per Kilogram
µg/L	Micrograms per Liter
NA	Not Analyzed
N/A	Not Applicable
NAVFACENGCOM	Naval Facilities Engineering Command
NC	North Carolina
NCAC	North Carolina Administrative Code
NCDENR	North Carolina Department of Environment and Natural Resources
NCDOC	North Carolina Department of Corrections
NCDOT	North Carolina Department of Transportation
NCSP	North Carolina State Plane
NCSPA	North Carolina State Ports Authority
NE	None Established
NM	Not Measured
NMT	No Measurable Thickness
NS	Not Sampled
o-	ortho
OVA	Organic Vapor Analyzer

p-	para
PAH	Polynuclear Aromatic Hydrocarbons
Pb	Lead
PPB	Parts Per Billion
PPM	Parts Per Million
PID	Photo Ionization Detector
PQL	Practical Quantitation Limit
PVC	Polyvinyl chloride
RBCA	Risk-Based Corrective Action
RCRA	Resource Conservation and Recovery Act
Res	Residential
ROI	Radius of Influence
RRO	Raleigh Regional Office
SOW	Scope of Work
STGW	Soil-to-Groundwater
SVE	Soil Vapor Extraction
SVOC	Semi Volatile Organic Compound
TDHF	Toxicologically Defined Hydrocarbons Fractions
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compound
TKN	Total Kjeldahl Nitrogen
TOC	Top of Casing
TPH	Total Petroleum Hydrocarbons
US	United States
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compounds
VPH	Volatile Petroleum Hydrocarbons
WaRO	Washington Regional Office
WiRO	Wilmington Regional Office
WSRO	Winston-Salem Regional Office

REMEDIAL ACTION OPTIMIZATION
&
REVISED CORRECTIVE ACTION PLAN
BUILDING 1613

MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

CATLIN PROJECT NO. 203-063

FEBRUARY 12, 2004

EXECUTIVE SUMMARY

This report is intended to provide information relevant to address and review the effectiveness of current remedial actions being conducted at Building 1613 and make revisions to the Corrective Action Plan (CAP) in order to achieve site closeout. The project site is located within the Hadnot Point area of Marine Corps Base (MCB), Camp Lejeune.

The project site consists of a single story building (Building 1613) with three concrete pump islands on both the east and west sides of the building. Four gasoline Underground Storage Tanks (USTs) that were reportedly installed in the 1950's and removed in January 1995 were located northeast of Building 1613. Various site assessment activities were completed to delineate the presence and, if applicable, extent of free-phase product, soil contamination, and groundwater contamination. The reports from these various site assessments were utilized by CATLIN Engineers and Scientists (CATLIN) to develop a CAP dated April 6, 1998. These site assessment reports have been referenced within the CAP.

The CAP identified the presence of free-phase product and dissolved groundwater contamination. The recommended remediation strategy within the CAP for site restoration was a treatment system consisting of Aggressive Fluid Vapor Recovery (AFVR) technology for the recovery of free-phase product, air sparging coupled with soil vapor extraction (AS/SVE) and natural attenuation (near outer limits of plume) for the remediation of contaminated groundwater. It is our understanding that OHM Remediation Services (OHM) installed an AS/SVE treatment system in mid 1998 and began operation in October 1998.

In September 2000, an additional investigation was completed by OHM and the existing AS/SVE system was expanded.

The remedial goals set forth in the CAP for the site were based on the regulations that were enforced at the time. The cleanup goals for groundwater were the NCAC T15A:02L Groundwater Quality Standards (2L GWQS) and for soils were 10 mg/kg Total Petroleum Hydrocarbons – Gasoline Range Organics (TPH – GRO) and 40 mg/kg TPH – Diesel Range Organics (DRO). Since submittal of the CAP, the State regulations have changed. The current applicable remedial requirements for this site are the Risk Based Corrective Action (RBCA) for Petroleum Underground Storage Tanks per 15A NCAC 2L .0106 effective date January 2, 1998 and document entitled *"Guidelines for Assessment*

and Corrective Action" (2001 Guidelines) as released by the North Carolina Department of Environment and Natural Resources (NCDENR) Division of Waste Management, UST Section, effective July 1, 2001. With the implementation of these new regulation and guidelines, we propose using the Gross Contaminant Levels (GCLs) and the Industrial/Commercial Maximum Soil Contaminant Concentrations (MSCCs) as the new "clean up" goals for groundwater and soil, respectively.

Based on a review of the analytical data it appears that no soil samples have been obtained for the current Risk Based Analyses; however, it appears from an evaluation of previous TPH analyses, that only one area of soil contamination was identified in the vicinity of the soil borings SB-23 and SB-24 by Shaw in September 2000. Based on the documented source of contamination to be gasoline, CATLIN recommends obtaining soil samples in these two locations and performing Risk Based Analyses on each sample as follows: EPA Method 8260 with IPE and MTBE, and MADEP VPH/EPH. The results of these soil samples should be presented within a Soil Assessment Report in accordance with the 2001 Guidelines.

Review of the analytical data indicates that groundwater contaminant levels have been reduced to below current risk based cleanup goals. Therefore, no further remedial efforts appear to be necessary and the active remedial system should be shutdown. Groundwater sampling is proposed for one year on a quarterly basis subsequent to system shutdown to ensure groundwater contaminants do not rebound. Upon completion of four consecutive quarters of post-operational sampling with contaminant levels below current GCLs and the completion of the additional soil sampling, a request for No Further Action may be requested with applying Land Use Restrictions (LURs).

REMEDIAL ACTION OPTIMIZATION
&
REVISED CORRECTIVE ACTION PLAN
BUILDING 1613

MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

CATLIN PROJECT NO. 203-063

FEBRUARY 12, 2004

1.0 BACKGROUND

1.1 PURPOSE OF REPORT

The purpose of this report is to provide information relevant to address and review the effectiveness of current remedial actions being conducted at Building 1613 located at the MCB, Camp Lejeune. Additionally, this report provides revisions to the CAP in order to achieve site closure. This report has been formatted according to the Naval Facilities Engineering Command (NAVFACENGCOM) "Guidance for Optimizing Remedial Action Operation" document prepared by Radian International and dated April 2001 with the ultimate purpose to "achieve environmentally protective site closeout at the least cost."

The work conducted herein was conducted in general accordance with the Workplan titled Remediation System Optimization Plans at the Various Sites, Marine Corps Base, Camp Lejeune, North Carolina dated July 16, 2003. CATLIN was authorized to perform this investigation by the LANTDIV NAVFACENGCOM in accordance with the Order of Supplies Contract Number N62470-01-D-3009, Delivery Order Number 0079.

1.2 SCOPE OF WORK

This Remedial Action Optimization & Revised Corrective Action Plan (RAO & RCAP) was developed in general accordance with the NAVFACENGCOM "Guidance for Optimizing Remedial Action Operation" document dated April 2001 and the 2001 Guidelines. Specific methods utilized to develop the RAO & RCAP included a thorough collection and review of available reports and field data. In addition, a field reconnaissance was conducted to perform on-site inspections of existing site and remedial system conditions and conduct personal interviews with the system operators. Data was then reviewed and the RAO & RCAP was developed.

2.0 SITE HISTORY

(Refer to Table 1, Figures 1, 2, and 3)

The Building 1613 project site consists of an active Marine Corps Community Services (MCCS) gas station located on the northwest side of West Street between Gum and Fir Streets in the Hadnot Point area of MCB, Camp Lejeune, Onslow County, North Carolina. See Figure 1 for approximate location of the site.

The project site consists of a single story building (Building 1613) with three concrete pump islands on the east and west sides of the building. The two concrete pump islands closest to either side of the building contain two petroleum dispensers per pump island. The dispensers that were located in the outer concrete pump islands were reportedly removed prior to the mid-1980's. A canopy extends from the building to the second concrete pump island to the east and the west. A portion of the site is covered with pavement. The attached Figure 2 illustrates the current site layout.

Four gasoline USTs were reportedly installed in the 1950's and removed in January 1995. They were located northeast of Building 1613. The gasoline USTs consisted of one 10,000-gallon tank, two 30,000-gallon tanks, and one 9,000-gallon tank. These USTs were replaced by three Above-ground Storage Tanks (ASTs) located northwest of the building as illustrated on Figure 2.

Various site assessment activities were completed to delineate the presence and, if applicable, the extent of free-phase product, soil contamination, and groundwater contamination. The reports from these various site assessments were utilized by CATLIN to develop a CAP dated April 6, 1998. These site assessment reports have been referenced within the CAP.

The CAP stated that free-phase product was being recovered from well HPGW-6 by an active skimming recovery system. As of this RAO & RCAP, CATLIN has not obtained the operational information for this system. The active skimming recovery system is not known to be operational at this time.

The CAP identified the presence of free-phase product and dissolved groundwater contamination. The recommended remediation strategy within the CAP for site restoration was a treatment system consisting of AFVR technology for the recovery of free-phase product, air sparging coupled with soil vapor extraction (AS/SVE) and natural attenuation for the remediation of contaminated groundwater. It is our understanding that OHM installed an AS/SVE treatment system in mid 1998 and began operation in October 1998. Please note that OHM is now known as Shaw Environmental, Inc. (Shaw).

As per the request of NCDENR, OHM conducted an additional soil investigation in September 2000 to verify soil contamination was not present in the vicinity of the fuel dispensers and buried transfer piping at the site. Results from the additional soil assessment indicated two locations with TPH-GRO and TPH-DRO above the target concentrations

established in the CAP. However, OHM stated that the MADEP VPH and EPH concentrations of these samples were below the risk-based cleanup levels and active remediation of the soils was not required. This additional soil data was submitted by OHM in a report titled, *"Additional Soil Assessment Building 1613, Marine Corp Base, Camp Lejeune, Onslow County, North Carolina"* dated January 2001 with the recommendation of no further soil assessment.

Concurrent with the soil investigation, OHM conducted a groundwater investigation to better define the extent of groundwater contamination at the site. Two areas were identified with dissolved groundwater contamination that was not being treated by the original remedial system layout. This additional groundwater assessment and system expansion recommendation was submitted by OHM in a report titled, *"Additional Groundwater Assessment Building 1613, Marine Corp Base Camp Lejeune, Onslow County, North Carolina"* dated January 2001. OHM expanded the AS/SVE treatment system to address these additional areas of groundwater contamination in March and April 2001. The expanded portion of the system has been operational since late April 2001.

The current remediation system location is illustrated on Figure 3.

2.1 CONCEPTUAL SITE MODEL (BASED ON 1998 CAP)

2.1.1 Site Geology

The topography of the project site is relatively flat. Geology under the site was documented to be interfingering layers of very fine to medium grained sands, silty sands/sand-clay mixtures, and sand-limestone mixtures to a depth of approximately 52 feet or greater.

2.1.2 Groundwater Elevation and Flow Direction

The CAP documented groundwater flow direction exhibited a somewhat erratic flow pattern, possibly resulting from alterations in natural recharge areas, leakage from the subsurface utilities and the free product recovery system. It was anticipated that localized groundwater flows in the direction of the nearest discharge area being tributaries to Beaverdam Creek to the north of the project site.

Shaw has obtained depth to groundwater measurement from selected Type II and Type III monitoring wells during the numerous sampling and gauging events that have been conducted at the subject site. Groundwater elevation contours for the shallow monitoring wells, as interpreted by Shaw from the June and December 2002 gauging events, appears to flow from the northeast and the southwest (toward the center of the subject site) and then flow toward the south which supports the erratic flow pattern documented within the CAP.

2.1.3 Potential Receptors

A potential receptor survey completed by CATLIN and presented in the April 6, 1998 CAP documented the following potential receptors:

- CATLIN identified no active water supply wells within 1,500 feet of the site. However, one out-of-service (inactive) (HP603) and two permanently abandoned (HP-601 and HP-608) water supply wells were identified within 1,500 feet of the site.
- An unnamed tributary to Beaverdam Creek located approximately 1,000 feet north of the site. The remedial system was anticipated to control the migration of the dissolved groundwater contamination and, therefore, impact was not likely.

No other potential receptors were identified in the CAP.

2.1.4 Contaminants of Concern

(Refer to Appendix A)

Free-phase product was identified as a contaminant of concern during the preparation of the CAP. Soil contamination was not identified within the CAP. The contaminants of concern for the groundwater along with the associated action levels established within the CAP are provided in Appendix A.

3.0 REMEDIAL ACTION REVIEW

3.1 REMEDIAL SYSTEM OBJECTIVES

As detailed in the CAP, the remedial objectives set forth in the report were to provide proposed mechanisms by which free-phase product would be removed from the subsurface to the extent practicable and ground water contamination levels would be reduced to levels specified by T15A NCAC 2L .0202.

The CAP evaluated numerous remedial technologies for the site. The CAP recommended a combination of technologies to meet the remedial goals established in the previously discussed objectives. These included:

- AFVR for the removal of free-phase product contamination in monitoring wells HPGW-6, 1613-17, and 1613-18.
- Air sparging for the volatilization of dissolved-phase hydrocarbon constituents coupled with soil vapor extraction for the collection and discharge to the atmosphere of the generated, fugitive petroleum hydrocarbon vapors.

- Natural attenuation of low concentration dissolved hydrocarbon contamination near the outer perimeter of the plume.

3.2 IMPLEMENTED REMEDIAL SYSTEM

(Refer to Figure 3)

As previously documented, the CAP proposed the removal of free-phase product by use of AFVR technology. As of the preparation of this RAO & RCAP, CATLIN could not confirm or deny if the AFVR technology had been implemented at the site and if so the cumulative quantity removed. However, the 2002 Annual Monitoring Report stated that monitoring well HPGW-6 had last displayed free-phase product as recently as 2000.

Subsequent to CAP approval, OHM in October 1998 installed the AS/SVE portion of the recommended remedial system. Initially, 10 air sparge wells were installed to an approximate depth of approximately 35 feet BLS, and 20 soil vapor extraction wells were installed to an approximate depth of approximately 8 feet BLS.

Additional groundwater assessment activities were conducted by OHM and completed in September 2000. The additional groundwater assessment was performed to attempt to further define the dissolved petroleum constituents in the shallow groundwater to 2L GWQS and make recommendations regarding any additional remediation that may have been required at the site. Results of the additional groundwater assessment activities were detailed in the report completed by OHM titled Final Additional Groundwater Investigation Report, Building 1613, MCB, Camp Lejeune, North Carolina, dated January 2001. OHM evaluated the assessment data and concluded that expansion of the existing AS/SVE system was necessary in the vicinity of HPGW-6, the former UST basin and along the northwest side of West Street. In March/April 2001, OHM expanded the groundwater remediation system by the addition of five AS/SVE well pairs constructed to the same details as the initial well pairs. The current remedial system layout is presented on Figure 3.

3.3 REMEDIAL SYSTEM STATUS

As detailed in the 2002 Annual Monitoring Report for Building 1613 prepared by Shaw dated July 2003, the remedial system has run essentially continuously since November 16, 1998. Minor downtime periods have occurred for minor equipment repairs and routine maintenance. Field reconnaissance conducted by CATLIN personnel in conjunction with Shaw personnel revealed the system to be well maintained and in good working condition. All portions of the system were reported to be operational and functional with the exception of a heat exchange unit that is currently not in use.

3.4 MONITORING STATUS

Groundwater sampling and analysis is currently conducted on 7 Type II monitoring wells (1613-06, 1613-10, 1613-11, 1613-20, 1613-21, 1613-22 and HPGW6) and one Type III monitoring well (1613-16) on a semi-annual basis (Typically June and December). The groundwater samples are analyzed for Polynuclear Aromatic Hydrocarbons per EPA Method 610 and volatile organic compounds per EPA Method 624. These sampling events are summarized in annual monitoring reports prepared by Shaw and on file in the WiRo.

4.0 REMEDIATION EFFECTIVENESS EVALUATION

According to Shaw's 2002 Annual Monitoring Report, a total of 35,470 pounds of hydrocarbon compounds have been recovered by the system since startup in October 1998. Shaw bases the quantity of recovered hydrocarbon on stack emission calculations performed on a monthly basis. As previously stated, Shaw has reported the system to be continuously operated since the start-up in October 1998, with the exception of minor equipment repairs and routine maintenance.

4.1 FREE PRODUCT

(Refer to Figure 5)

As previously documented, the CAP proposed the removal of free-phase product by use of AFVR technology. As of the preparation of this RAO & RCAP, CATLIN could not confirm if the AFVR technology had been implemented at the site and if so the cumulative quantity removed. However, the 2002 Annual Monitoring Report stated that monitoring well HPGW-6 had displayed free-phase product as recently as 2000. Therefore, CATLIN has not determined the effectiveness of the AFVR technology but has assumed that free-phase product has not been present at the subject site since 2000. Comparisons of the CAP versus the December 2002 free-phase product plumes are illustrated on Figure 5.

4.2 CONTAMINANT CONCENTRATIONS

4.2.1 Soil

(Refer to Appendix B and Figure 4)

Soil TPH concentrations reported in the CAP were below the laboratory detection limits. As previously referenced, OHM conducted an additional soil investigation in September 2000 to verify soil contamination was not present in the vicinity of the fuel dispensers and buried transfer piping at the site. Results from the additional soil assessment indicated two locations with TPH-GRO and TPH-DRO above the target concentrations established in the CAP. However, OHM stated that the MADEP VPH and EPH concentrations of these samples were below the risk-based cleanup levels and active

remediation of the soils was not required. A summary of the historical soil laboratory analytical results have been provided in Appendix B and Figure 4.

4.2.2 Groundwater

(Refer to Table 1, Figures 6 through 10, and Appendices A and C)

Groundwater contamination at the time of the CAP preparation (May 1995 data) has been provided on the attached Figures 6 to 10. The CAP identified benzene, toluene, ethylbenzene, total xylenes, and naphthalene as the target contaminants of concern. The maximum concentration of these contaminants, as reported in the CAP, is provided in Appendix A.

The most recent estimated plume boundaries as presented by Shaw from the June 2003 sampling event are shown for benzene, toluene, ethylbenzene, total xylenes, and Total EPA Method 610 on Figures 6 through 10. As can be seen, the estimated extent of groundwater contamination has been reduced significantly by the active remediation system and only the groundwater in the vicinity of the section between monitoring wells 1613-17 and 1613-21 (See Figures 6 to 10) remains with contaminant concentration in excess of the 2L GWQS. Based on the latest June 2003 data provided by Shaw, the maximum contaminant concentrations of benzene, toluene, ethylbenzene, total xylenes, benzo(a)anthracene and naphthalene are above the 2L GWQS. The maximum concentrations of dissolved petroleum constituents identified in previous sampling events are presented on Table 1. Historical groundwater analytical data from the Annual Monitoring Reports and data prepared by Shaw are included in Appendix C.

4.3 SYSTEM SUITABILITY

Based on a review of the system performance, the reduction and subsequent removal of free product, and the reduced levels of groundwater contamination, the remediation system appears to have been effective in reducing the Contaminants of Concern (COCs).

5.0 REMEDIATION MODIFICATIONS AND ALTERNATIVES

5.1 REGULATORY FRAMEWORK EVALUATION

(Refer to Appendix D)

As previously discussed, the remedial goals for the site were based on the regulations current at the time and presented in the CAP. Current applicable remedial requirements for this site are the Risk Based Corrective Action (RBCA) rules for Petroleum Underground Storage Tanks per 15A NCAC 2L .0106 which became effective on January 2, 1998 and the requirements in the NCDENR 2001 Guidelines. As such, reclassification of the site based on current risk factors was necessary. A

Risk Classification and Land Use Form, as presented in the 2001 Guidelines was completed to present the data necessary to allow NCDENR to assess the site's applicable risk classification.

The completed form is included in Appendix D. Based on the findings of this Risk Classification and Land Use Form, CATLIN concludes that the subject site meets the criteria for classification as a Low Risk and Industrial/Commercial Land Use site. This ranking revises the target cleanup goals for both soil and groundwater (see Section 5.3).

5.2 REVISED CONCEPTUAL SITE MODEL

5.2.1 Groundwater Depth and Flow Direction

Groundwater elevation contours for the shallow monitoring wells, as interpreted by Shaw from the June and December 2002 gauging events, appears to flow from the northeast and the southwest (toward the center of the subject site) and then flow toward the south which supports the erratic flow pattern documented within the CAP. Therefore, no change to the groundwater flow characteristics is necessary in the revised conceptual model.

5.2.2 Potential Receptors

(Refer to Figure 1 and Appendix D)

The potential receptors have been re-evaluated during the preparation of this RAO & RCAP using the Risk Classification and Land Use Form in Appendix D. Based on the risk characterization, this site appears to be a Low Risk Site and classified as Industrial/Commercial land use. A receptor survey performed as part of this plan identified no additional potential receptors within the area of investigation. Potential receptors are illustrated on the attached Figure 1. All water supply wells previously identified within 1,500 feet of the subject site have been permanently abandoned. An unnamed tributary of Beaverdam Creek lies approximately 1,050 feet north of the subject site and a pond was located approximately 1,230 feet north of the site.

5.2.3 Contaminant of Concern

The COC as established in the CAP are still relevant, however, Shaw has reported additional contaminants since system start-up in their annual monitoring reports above the 2L GWQS. Therefore, the COCs have been expanded to include the additional contaminants reported by Shaw. The new COCs are provided on the attached Table 2. Additionally, soils are required by the 2001 Guidelines to have chemical specific testing and cleanup levels.

5.3 ALTERNATIVE REGULATORY MECHANISMS

5.3.1 Revised Target Cleanup Goals

(Refer to Tables 1 and 2)

Based on the risk characterization study discussed above, it appears that the revised applicable cleanup concentration for soil is based on the Industrial/Commercial MSCCs. Soil contamination data presented in the CAP and the Additional Soil Assessment report from this site were based on the TPH-Gasoline and TPH-Diesel Action Levels and limited Risk Based Analyses (2000 Data only). No soil samples have been obtained for Risk Based Analysis; however, it appears from an evaluation of previous TPH analyses, that only one area of soil contamination was identified in the vicinity of the soil borings identified as SB-23 and SB-24 by Shaw during the Additional Soil Assessment activities in September 2000. As such, additional soil sampling for Risk Based Analysis is recommended (see Section 7.1 Implementation Plan). The Revised Target Cleanup Concentrations are illustrated on Table 2.

Additionally, based on the risk characterization study discussed above, it appears the Revised Target Cleanup Concentrations for groundwater are based on the GCLs. As previously discussed, groundwater contaminants currently identified at the site above the 2L GWQS are benzene, toluene, ethylbenzene, total xylenes, and naphthalene. While the concentrations are above the 2L GWQS, they are well below the applicable GCLs. The maximum groundwater concentrations from the June 2003 sampling event as compared to the GCLs are presented on Table 2. As can be seen in Table 1, no constituents have been identified above GCLs since the CAP preparation.

Please note that the last confirmed date of free-phase product has not been established as of the preparation of this RAO & RCAP. However, free-phase product was not identified during the 2001, 2002 or June 2003 sampling events.

5.3.2 Land Use Restrictions

As required by the NCDENR, LURs must be prepared and recorded where contaminants in groundwater remain at concentrations that exceed the 2L GWQS or soil contaminant concentrations exceed the Industrial/Commercial MSCC. At this site, based on the most recent sampling event, benzene, toluene, ethylbenzene, total xylenes, and naphthalene concentrations dissolved in groundwater are in excess of the 2L GWQS. Therefore, LURs are necessary for site closure.

Marine Corps Base, Camp Lejeune is currently in the process of producing a legal document acceptable to State and Federal Government agencies to accomplish the intent of the LURs.

5.4 ALTERNATIVE REMEDIAL TECHNOLOGIES

No alternative remedial technologies are necessary to accomplish the ultimate goal of site closure. The implemented remedial system has been effective in reducing the contaminant levels to below the Revised Target Cleanup Concentrations.

5.5 COST EFFICIENCY EVALUATION

A detailed cost efficiency evaluation was not performed for this site. The recommendation for shutdown of the active remediation system is based on a comparative evaluation of the implementation of system shutdown and monitoring procedures versus continuation of system operation to achieve closure based on 2L GWQS criteria. The current plan of system shutdown and quarterly monitoring will be necessary regardless of the chosen method. Therefore, the only benefit of the continued operation of the system would be to attempt to achieve compliance with current 2L GWQS which would allow for site closure without LURs. The comparative cost of continued system operation versus preparation of LURs would be substantially higher resulting in system shutdown as the most economically feasible alternative.

6.0 OPTIMIZATION RECOMMENDATIONS

6.1 SOIL

(Refer to Figure 4)

Based on the Revised Target Cleanup Concentrations discussed within Section 5.3.1 of this report, CATLIN recommends collecting additional soil samples for Risk Based Analysis in the vicinity of the following locations: former soil borings SB-23 and SB-24 illustrated on Figure 4. Based on the documented source of contamination to be gasoline, CATLIN recommends Risk Based Analyses to be performed for each sample as follows: EPA Method 8260 with IPE and MTBE, and MADEP VPH/EPH. The results of these soil samples should be presented within a Soil Assessment Report in accordance with the 2001 Guidelines.

6.2 GROUNDWATER

(Refer to Table 1)

Based on the Revised Target Cleanup Concentrations discussed within Section 5.3.1 of this report, CATLIN recommends shut down of the active groundwater remediation system currently in operation at the site. Once shutdown, the system should be secured to assure that the integrity of the system and well network is not

jeopardized. Groundwater sampling is recommended on a quarterly basis subsequent to system shutdown for a total of four consecutive events to measure for rebound effects.

As previously referenced, no constituents have been identified above GCLs since 1998. Therefore, CATLIN recommends sampling all on-site monitoring wells only during the first and fourth quarters following system shut down. Only selected monitoring wells in the vicinity of the current groundwater contamination plume above the 2L GWQS are recommended to be sampled during the second and third quarters. These selected monitoring wells are as follows: 1613-06, 1613-10, 1613-11, 1613-20, 1613-21, 1613-22 and HPGW6. Based on the documented source of contamination to be gasoline and the historical contaminants of concern provided in Table 1, CATLIN recommends gauging and sampling the above referenced monitoring wells for the following Risk Based analyses: EPA Methods 601, 602 with IPE, MTBE, EDB and xylenes, and 625 (benzo(a)anthracene only) and MADEP VPH/EPH. The results of these four quarters of sampling should be evaluated and, if applicable, a Groundwater Monitoring Report with Site Closure be prepared and submitted to the NCDENR. In the event that groundwater contaminants rebound significantly (greater than the GCLs) then restarting the active remediation system should be considered.

Upon receipt of No Further Action with LURs, CATLIN recommends the selected monitoring wells referenced in the previous paragraph be sampled on a frequency of once every five years for the following analyses: EPA Methods 601, 602 with IPE, MTBE, EDB and xylenes, and 625 (benzo(a)anthracene only) and MADEP VPH/EPH. The results of these sampling events should be compared to the groundwater quality standard applicable at that time, currently the 2L GWQS. The LURs should be requested to be removed from the site at the time the selected monitoring wells meet the applicable groundwater quality standard.

7.0 IMPLEMENTATION

7.1 IMPLEMENTATION PLAN

The following is a suggested implementation plan for obtaining site closure:

- Submittal of RAO & RCAP to NCDENR for approval of recommendations.
- Shut down active remediation system.
- Initiate the quarterly groundwater sampling for one year.
- Collection of recommended soil samples.
- Preparation of a Soil Assessment Report. If additional soil contamination is detected then a Soil Cleanup Plan will be required otherwise proceed with site closure activities.
- Preparation of a Groundwater Monitoring Report with Site Closure request (if no rebound or soil contamination is present). Proceed with No Further Action

requirements with the LURs. As previously stated, Marine Corps Base, Camp Lejeune is currently in the process of producing a legal document acceptable to State and Federal Government agencies to accomplish the intent of the LURs.

- Upon receipt of the No Further Action with LURs, collect groundwater samples on a five-year frequency. Laboratory results should be compared to the applicable groundwater quality standards. Upon meeting the applicable groundwater quality standards, request removal of the LUR's.

7.2 SCHEDULE FOR IMPLEMENTATION

System shutdown is recommended to commence immediately upon plan approval by appropriate State authorities. Upon system shutdown, quarterly groundwater sampling should be conducted at the site for four consecutive events at which time site conditions should be evaluated to determine if a request for site closure is warranted. The upcoming June 2004 sampling event will be an appropriate milestone to begin the quarterly sampling activities.

8.0 LIMITATIONS

The field and groundwater data evaluated as part of this report provide isolated data points and may not represent conditions at every location in the project area. Analyses and conclusions of this report, being based on interpolation between data points at the project area, may not be completely representative of all site conditions. Conclusions and recommendations from this report are based on the best available data in an effort to comply with current regulatory requirements.

9.0 REFERENCES

CATLIN Engineers and Scientists (formerly Richard Catlin & Associates, Inc.), *Leaking Underground Storage Tank Corrective Action Plan, USTs 1613 1-4, Marine Corps Base, Camp Lejeune, North Carolina, Final,* April 6, 1998.

CATLIN Engineers and Scientists, *Statement of Work Design, Building 1613, USTs 1613 1-4, Marine Corps Base, Camp Lejeune, Final Submittal,* May 7, 1998.

North Carolina Department of Environment and Natural Resources, Division of Waste Management, UST Section, 2001, *Guidelines for Assessment and Corrective Action.* Effective July 1, 2001.

North Carolina Department of Environment and Natural Resources, Division of Water Quality, 2002, *Title 15A Subchapter 2L-Classifications and Water Quality Standards Applicable To The Groundwaters of North Carolina.* April 7, 2002.

North Carolina Department of Environment and Natural Resources, Groundwater Section, 1998, *Groundwater Section Guidelines for the Investigation and Remediation of Soils and Groundwater, Volume II: Petroleum Underground Storage Tanks,* Raleigh, North Carolina, January 2, 1998.

OHM Remediation Services Corp., *Additional Soil Assessment, Building 1613, Marine Corps Base Camp Lejeune, Onslow County, North Carolina,* November 2000.

OHM Remediation Services Corp., *Draft Workplan Construction and Operation of Air Sparging and Soil Vapor Extraction Remediation Systems with Aggressive Fluid Vapor Recovery, Hadnot Point Fuel Farm Building 1613, Marine Corps Base, Camp Lejeune, North Carolina,* August 1998.

OHM Remediation Services Corp., *Final Additional Groundwater Investigation, Building 1613, Marine Corps Base Camp Lejeune, Onslow County, North Carolina,* January 2001.

OHM Remediation Services Corp., *Final Annual Monitoring Report, Building 1613, Marine Corps Base, Camp Lejeune, Onslow County, North Carolina,* June 2002.

OHM Remediation Services Corp., *Operation and Maintenance Manual, SVE/Air Sparge Treatment System, Bldg. 1613, MCB Camp Lejeune, North Carolina,* March 1999.

Radian International, 2001, *Guidance for Optimizing Remedial Action Operation.* Prepared for Naval Facilities Engineering Service Center, Port Hueneme, California. Report dated April 2001.

Shaw Environmental Inc., *2002 Annual Monitoring Report, Building 1613, Marine Corps Base Camp Lejeune, Onslow County, North Carolina,* May 2003.

TABLES

TABLE 1

SUMMARY OF HISTORICAL GROUNDWATER CONTAMINANTS OF CONCERN

REMEDIAL ACTION OPTIMIZATION
&
REVISED CORRECTIVE ACTION PLAN
BUILDING 1613

MARINE CORPS BASE, CAMP LEJEUNE, NC

COMPOUND	2L GWQS (µg/L)	GCL (µg/L)	MAXIMUM CONCENTRATIONS (µg/L)						
			CAP DATA	1998	1999	2000	2001	2002	2003
Benzene	1	5,000	17,300	90	930	5,160	1,700	<20	289
Toluene	1,000	257,500	20,700	<1.0	4,600	2,040	3,100	669	2,060
Ethylbenzene	29	29,000	2,140	43	820	551	430	342	217
Total Xylenes	530	87,500	10,800	570	6,900	4,620	4,800	2,380	1,660
Trichloroethene	2.8	2,800	78.9	NA	NA	NA	NA	NA	NA
Chloromethane	2.6	2,600	5.3	NA	<250	<250	NA	NA	NA
Dichloremethane	5	5,000	NA	NA	<500	<400	NA	<100	NA
Methyl Tert-Butyl Ether	200	200,000	NA	<5.0	14,000	6,800	<1200	318	54.3
1,4 Dichlorobenzene	75	39,500	BQL	<1.0	<100	<80	<250	<20	<1.0
Benzo(a)Anthracene	0.05	22	NA	<0.1	<1.0	<5.5	<20	<21	<20
Naphthalene	21	15,500	303	25	120	114	43	125	47.8

Information obtained from Shaw Environmental, Inc.
CAP data was from the 1998 CAP by CATLIN.
NA= Not Analyzed
BQL = Below Quantitation Limits.
Shading represents concentrations above GCL.

TABLE 2

REVISED TARGET CLEANUP CONCENTRATIONS

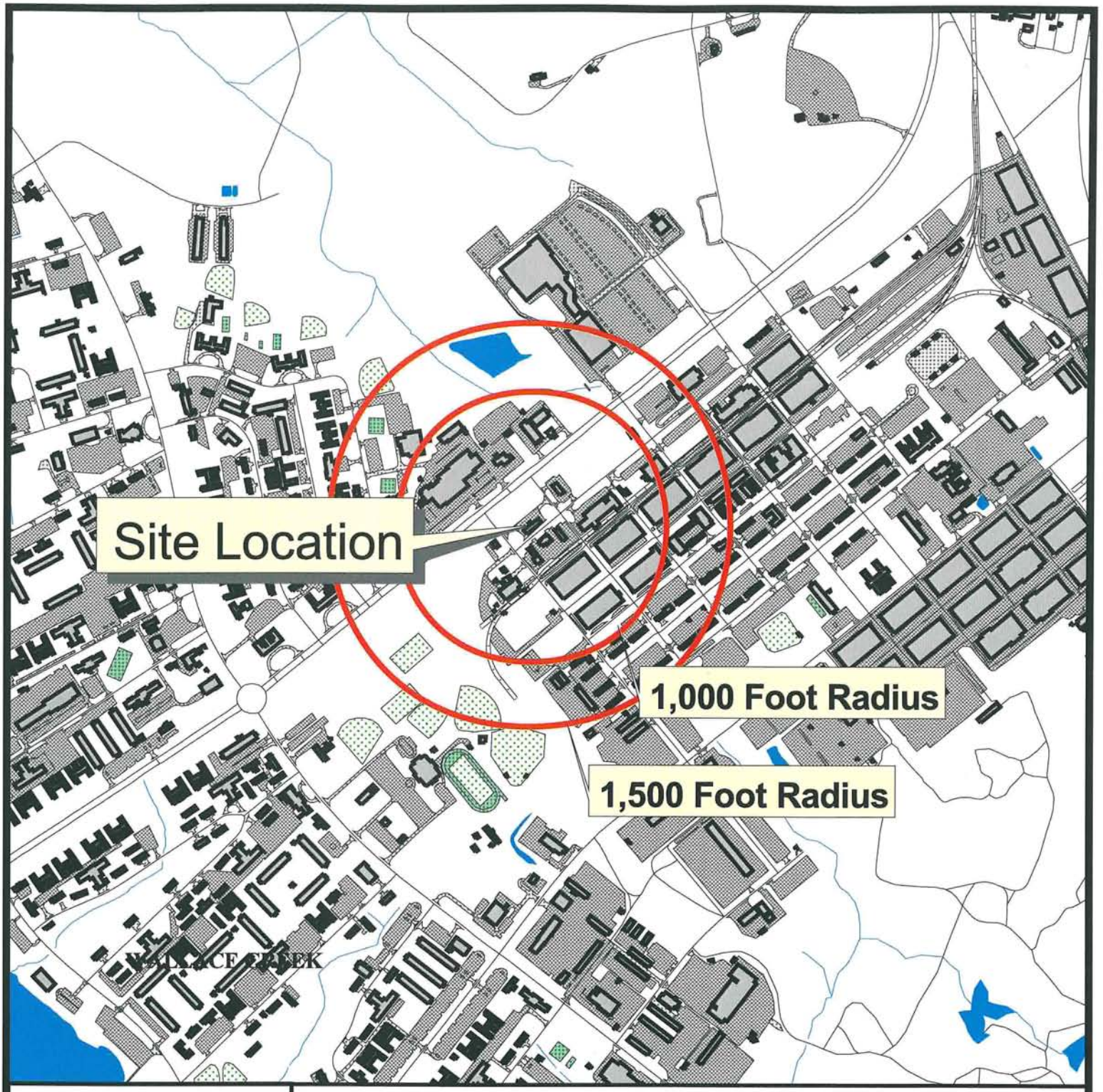
REMEDIAL ACTION OPTIMIZATION
&
REVISED CORRECTIVE ACTION PLAN
BUILDING 1613

MARINE CORPS BASE, CAMP LEJEUNE, NC

MEDIUM	COMPONENT	CURRENT CONDITIONS*	TARGET CLEANUP
Free Product	Gasoline/Diesel	No measureable thickness	<1/8"
Vadose Zone Soil	EPA Method 8260, EPA Method 8270, MADEP VPH/EPH	Unkown	Industrial/Commercial Maximum Soil Contaminant Concentrations
Groundwater	Benzene	289	5,000
	Toluene	2,060	257,500
	Ethylbenzene	217	29,000
	Total Xylenes	1,660	87,500
	Trichloroethene	NA	2,800
	Chloromethane	NA	2,600
	Dichloremethane	NA	5,000
	Methy Tert-Butyl Ether	54.3	200,000
	1,4 Dichlorobenzene	<1.0	39,500
	Benzo(a)Anthracene	<20	22
	Naphthalene	47.8	15,500

* Current data obtained from Shaw Environmental, Inc. for 6/21/03 sampling event.
NA= Not Analyzed

FIGURES



LEGEND

Water Supply Wells
- ACTIVE
- CLOSED
- INACTIVE
- PENDING

Roads
Railroads
Recreational Horse Trail
Buildings and Structures
Parking Lots
Playgrounds
Driveways
Athletic Fields
Athletic Courts
Surface Water
Creeks
Surface Water

1000 0 1000 Feet

SCALE

N
W E
S

CATLIN ENVIRONMENTAL CONSULTANTS

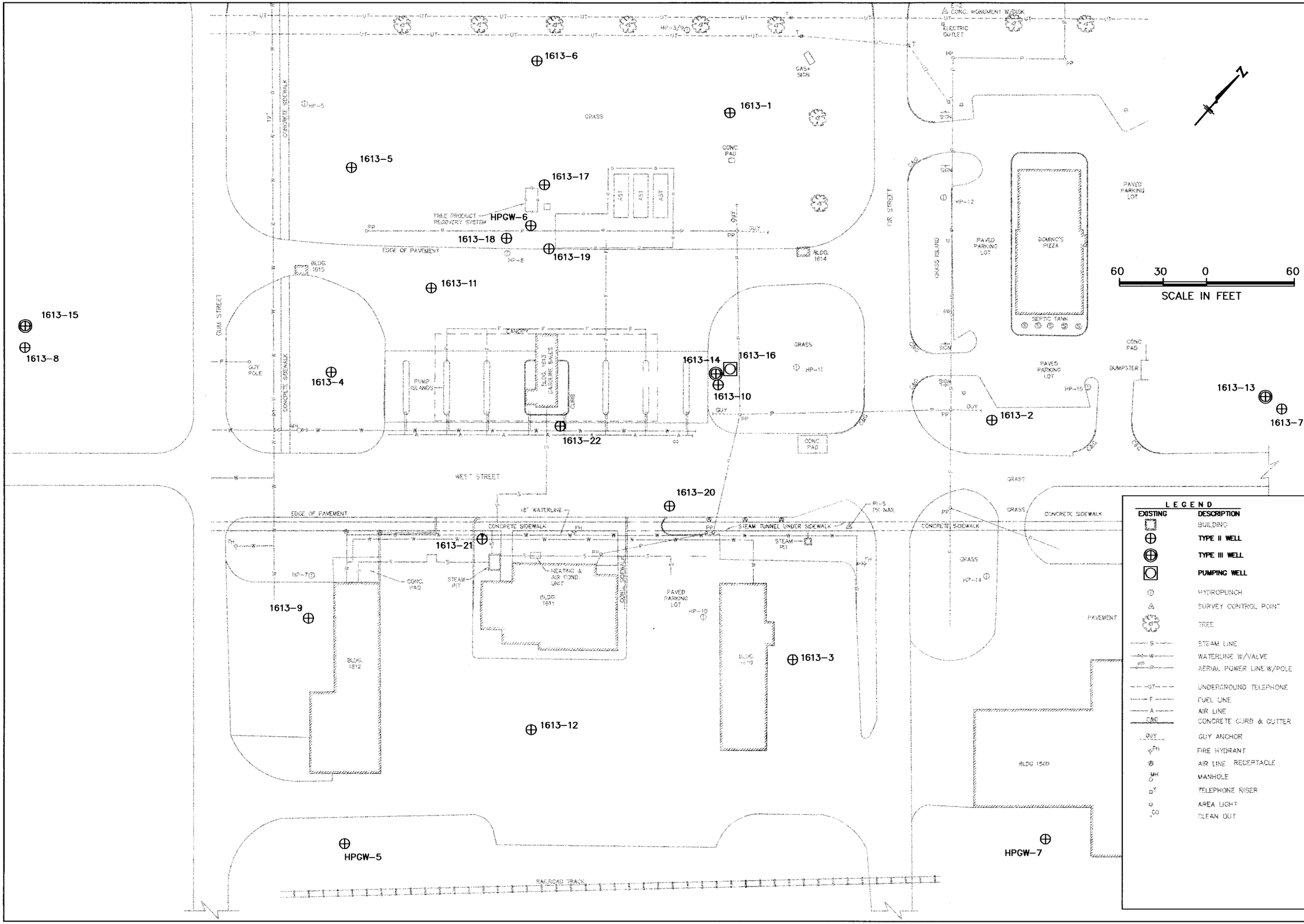
SITE LOCATION MAP

BUILDING 1613

FIGURE 1

DRAWN BY:	CHECK BY:	APPROVED BY:
THW	SVH	

CATLIN PROJECT No.: 203-063



LEGEND

EXISTING	DESCRIPTION
	BUILDING
⊕	TYPE II WELL
⊕	TYPE III WELL
◯	PUMPING WELL
ⓗ	HYDROPUNCH
△	SURVEY CONTROL POINT
	TREE
S	STEAM LINE
W	WATERLINE W/VALVE
PP	AERIAL POWER LINE W/POLE
UT	UNDERGROUND TELEPHONE
F	FUEL LINE
A	AIR LINE
C&G	CONCRETE CURB & GUTTER
GUY	GUY ANCHOR
FH	FIRE HYDRANT
ⓡ	AIR LINE RECEPTACLE
MH	MANHOLE
T	TELEPHONE RISER
☼	AREA LIGHT
CO	CLEAN OUT

203063-1613-GSFINAL-02

FIGURE 2

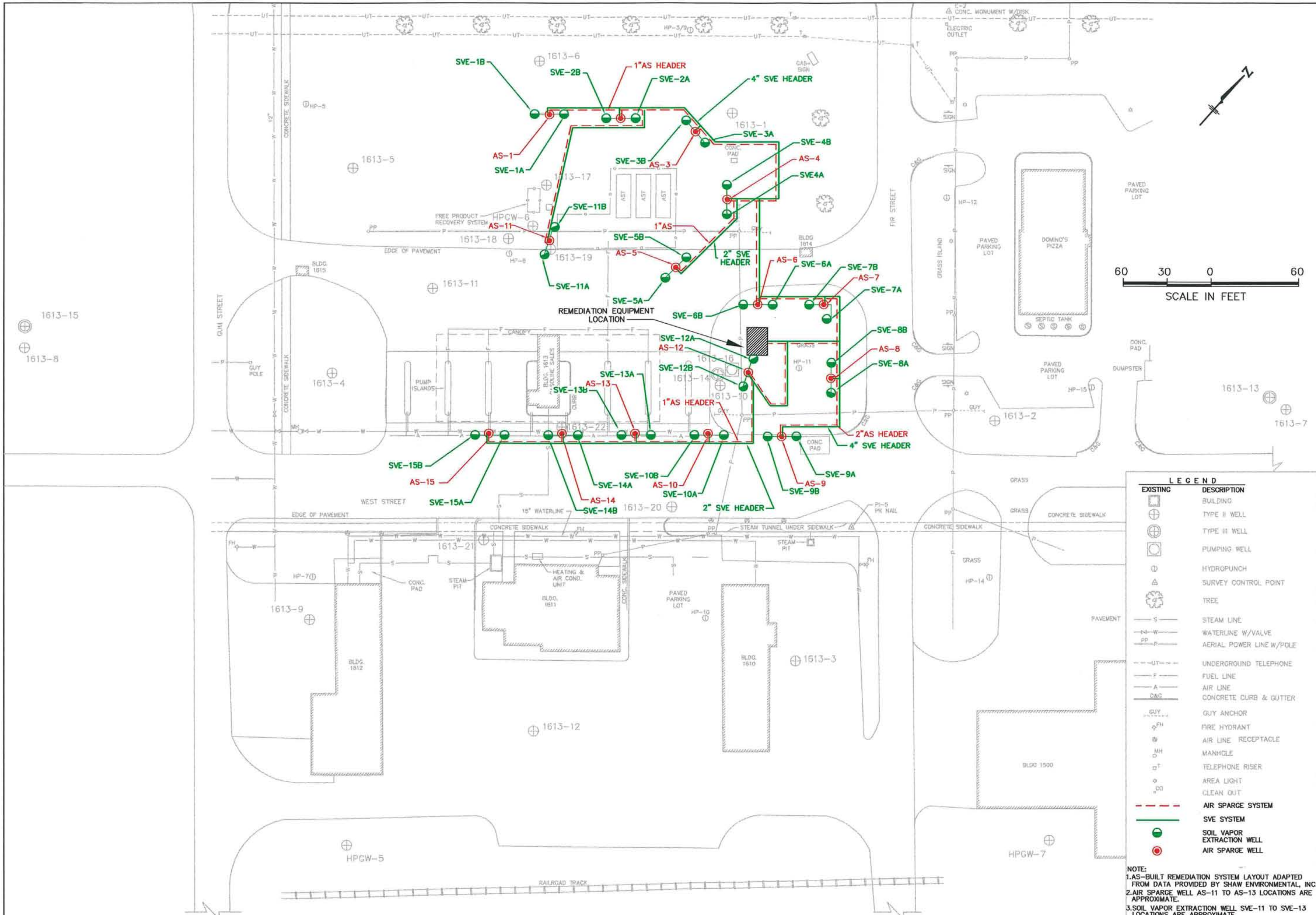
TITLE: SITE MAP WITH MONITORING WELL LOCATIONS

SCALE: 1"=60' | DRAWN BY: HCS | CHECKED BY: JKB

PROJECT: BUILDING 1613 MARINE CORPS BASE CAMP LEJEUNE, NC

JOB NO. 203063 | DATE: DEC 2003

CAMP DRESSER & MCKEE INC. WILMINGTON, NORTH CAROLINA


SVE-1B
SVE-1A
AS-1
SVE-2B
SVE-2A
1"AS HEADER
4" SVE HEADER
SVE-3A
SVE-3B
AS-3
SVE-4B
AS-4
SVE4A
SVE-11B
AS-11
1"AS
SVE-5B
AS-5
2" SVE HEADER
SVE-11A
SVE-5A
AS-6
SVE-6A
SVE-6B
SVE-7B
AS-7
SVE-7A
REMEDIATION EQUIPMENT LOCATION
SVE-12A
AS-12
SVE-12B
SVE-8B
AS-8
SVE-8A
SVE-13A
AS-13
SVE-13B
1"AS HEADER
2"AS HEADER
4" SVE HEADER
SVE-15B
AS-15
SVE-15A
SVE-14A
AS-14
SVE-14B
SVE-10B
AS-10
SVE-10A
2" SVE HEADER
SVE-9A
AS-9
SVE-9B
FREE PRODUCT RECOVERY SYSTEM
HPGW-6
1613-6
1613-5
1613-17
1613-1
1613-18
1613-19
1613-11
1613-15
1613-8
1613-4
1613-16
1613-14
1613-10
1613-22
1613-20
1613-21
1613-9
1613-12
1613-3
1613-2
1613-13
1613-7
HPGW-5
HPGW-7
GUM STREET
WEST STREET
FIR STREET
CONCRETE SIDEWALK
EDGE OF PAVEMENT
PUMP ISLANDS
CANOPY
STEAM TUNNEL UNDER SIDEWALK
18" WATERLINE
HEATING & AIR COND. UNIT
BLDG. 1611
BLDG. 1612
BLDG. 1610
BLDG 1500
BLDG 1615
BLDG 1614
DOMINO'S PIZZA
SEPTIC TANK
PAVED PARKING LOT
RAILROAD TRACK
60 30 0 60
SCALE IN FEET
N
LEGEND
EXISTING
DESCRIPTION
BUILDING
TYPE II WELL
TYPE III WELL
PUMPING WELL
HYDROPUNCH
SURVEY CONTROL POINT
TREE
STEAM LINE
WATERLINE W/VALVE
AERIAL POWER LINE W/POLE
UNDERGROUND TELEPHONE
FUEL LINE
AIR LINE
CONCRETE CURB & GUTTER
GUY ANCHOR
FIRE HYDRANT
AIR LINE RECEPTACLE
MANHOLE
TELEPHONE RISER
AREA LIGHT
CLEAN OUT
AIR SPARGE SYSTEM
SVE SYSTEM
SOIL VAPOR EXTRACTION WELL
AIR SPARGE WELL
NOTE:
1.AS-BUILT REMEDIATION SYSTEM LAYOUT ADAPTED FROM DATA PROVIDED BY SHAW ENVIRONMENTAL, INC.
2.AIR SPARGE WELL AS-11 TO AS-13 LOCATIONS ARE APPROXIMATE.
3.SOIL VAPOR EXTRACTION WELL SVE-11 TO SVE-13 LOCATIONS ARE APPROXIMATE.

203063-1613-03FINAL-03

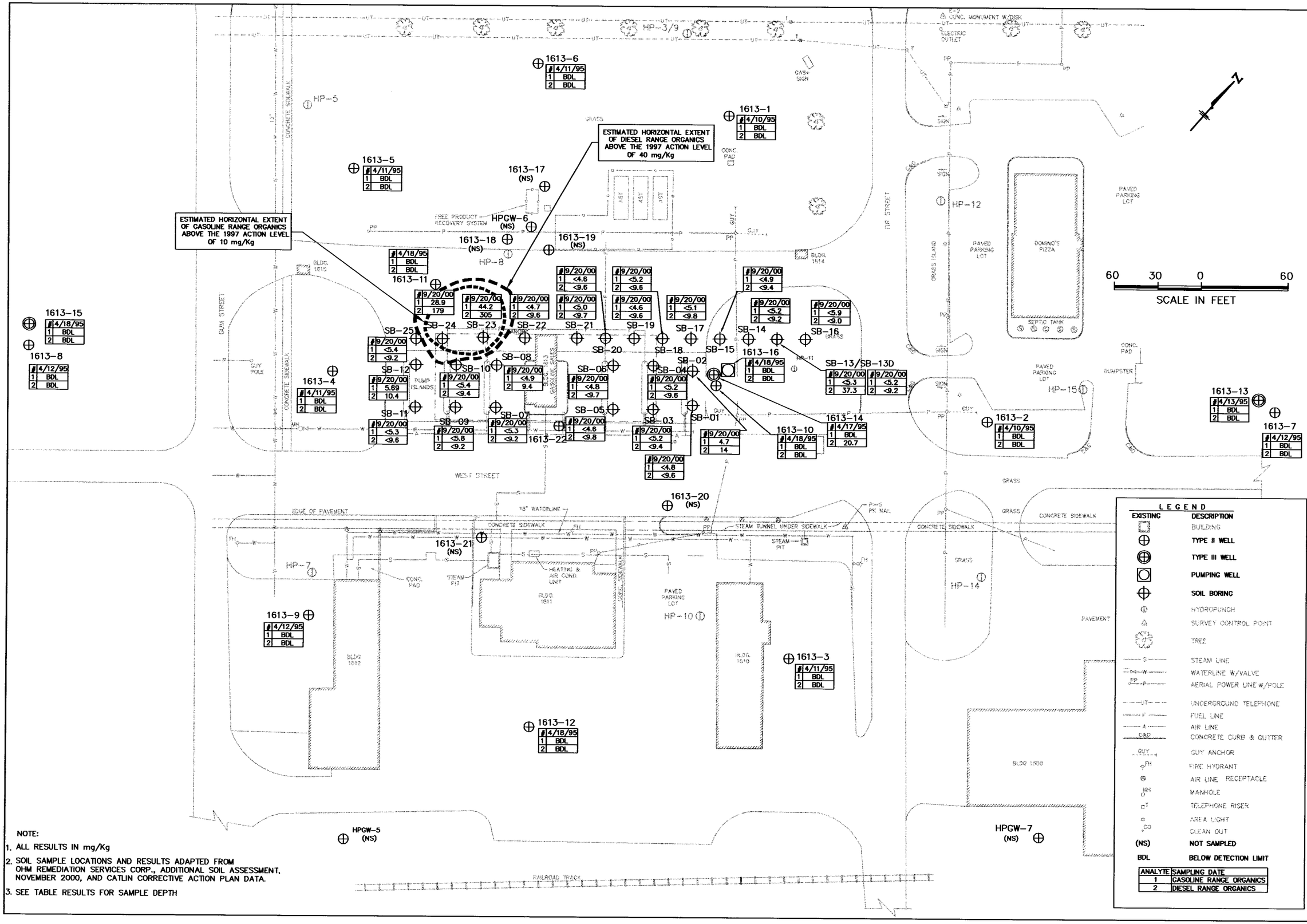
FIGURE 3

TITLE: REMEDIATION SYSTEM LAYOUT

PROJECT: BUILDING 1613
MARINE CORPS BASE
CAMP LEJEUNE, NC

JOB NO. 203063 | DATE: DEC 2003 | SCALE: 1"=60' | DRAWN BY: HCS | CHECKED BY: JKB

CATLIN ENGINEERS and SCIENTISTS
WILMINGTON, NORTH CAROLINA



203063-1613-03FINAL-04

FIGURE 4

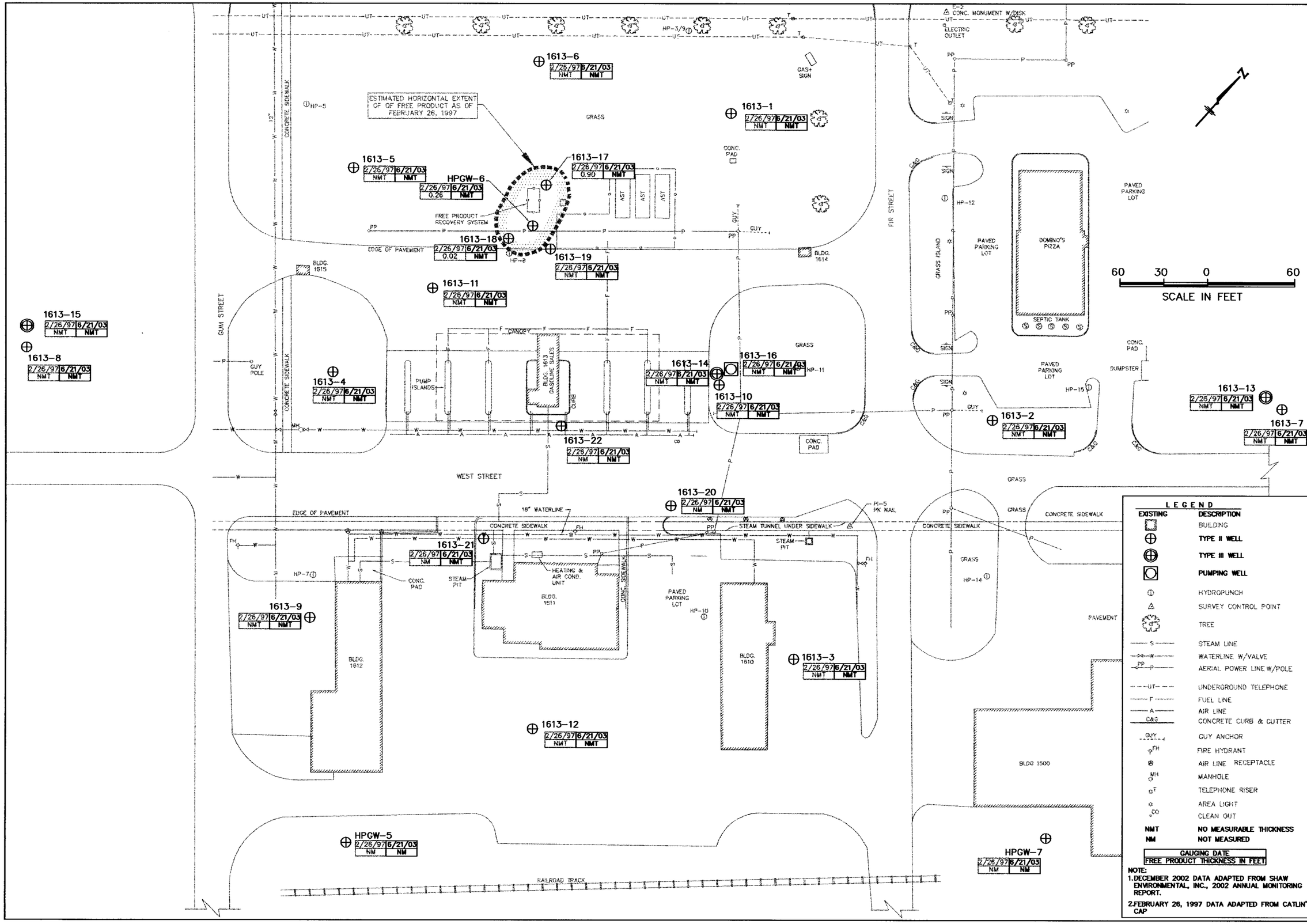
TITLE: HISTORICAL LABORATORY ANALYTICAL RESULTS - SOIL - TPH 5030/3550

SCALE: 1"=60' | DRAWN BY: HCS | CHECKED BY: JKB

PROJECT: BUILDING 1613 MARINE CORPS BASE CAMP LEJEUNE, NC

JOB NO. 203063 | DATE: DEC 2003

CATLIN ENGINEERS AND SCIENTISTS WILMINGTON, NORTH CAROLINA



LEGEND

EXISTING	DESCRIPTION
	BUILDING
	TYPE II WELL
	TYPE III WELL
	PUMPING WELL
	HYDROPUNCH
	SURVEY CONTROL POINT
	TREE
S	STEAM LINE
W	WATERLINE W/VALVE
P	AERIAL POWER LINE W/POLE
UT	UNDERGROUND TELEPHONE
F	FUEL LINE
A	AIR LINE
C&G	CONCRETE CURB & GUTTER
GUY	GUY ANCHOR
FH	FIRE HYDRANT
	AIR LINE RECEPTACLE
MH	MANHOLE
T	TELEPHONE RISER
	AREA LIGHT
CO	CLEAN OUT
NMT	**NO MEASURABLE THICKNESS**
NM	**NOT MEASURED**

GAUGING DATE
FREE PRODUCT THICKNESS IN FEET

NOTE:
1. DECEMBER 2002 DATA ADAPTED FROM SHAW ENVIRONMENTAL, INC., 2002 ANNUAL MONITORING REPORT.
2. FEBRUARY 26, 1997 DATA ADAPTED FROM CATLIN'S CAP

FIGURE 5

TITLE: FREE PRODUCT AS OF JUNE 2003

SCALE: 1"=60' | DRAWN BY: HCS | CHECKED BY: JKB

PROJECT: BUILDING 1613 MARINE CORPS BASE CAMP LEJEUNE, NC

JOB NO. 203063 | DATE: DEC 2003

203063-1613-03-FINAL-05

CATLIN ENGINEERING
WILMINGTON, NORTH CAROLINA

ESTIMATED HORIZONTAL EXTENT OF BENZENE ABOVE THE 2L GWQS OF 1 µg/L AS OF JUNE 21, 2003

ESTIMATED HORIZONTAL EXTENT OF BENZENE ABOVE THE 2L GWQS OF 1 µg/L AS OF MAY 1995

	5/4/95	6/21/03
1613-6	BDL	<1.0
1613-1	BDL	NS
1613-5	BDL	NS
1613-17	NS	NS
1613-18	NS	NS
1613-19	NS	NS
1613-11	8.8	0.52J
1613-16	5.0	<1.0
1613-14	BDL	NS
1613-10	804	0.59J
1613-15	BDL	NS
1613-8	BDL	NS
1613-4	BDL	NS
1613-13	BDL	NS
1613-7	BDL	NS
1613-2	BDL	NS
1613-22		289
1613-20		<1.0
1613-21		1.1
1613-9	BDL	NS
1613-12	BDL	NS
1613-3	BDL	NS

HP-5	4/6/95 BDL
HP-3/9	
HPGW-6	6/21/03 183
HP-8	4/5/95 17,300
HP-11	4/6/95 7,700
HP-12	4/5/95 BDL
HP-15	4/5/95 BDL
HP-7	4/12/95 BDL
HP-10	4/6/95 BDL
HP-14	4/5/95 0.6
HPGW-5	
HPGW-7	

60 30 0 60
SCALE IN FEET

LEGEND

EXISTING	DESCRIPTION
	BUILDING
⊕	TYPE II WELL
⊕	TYPE III WELL
▣	PUMPING WELL
⊕	HYDROPUNCH
△	SURVEY CONTROL POINT
	TREE
S	STEAM LINE
W	WATERLINE W/VALVE
PP	AERIAL POWER LINE W/POLE
UT	UNDERGROUND TELEPHONE
F	FUEL LINE
A	AIR LINE
C&G	CONCRETE CURB & GUTTER
GUY	GUY ANCHOR
FH	FIRE HYDRANT
	AIR LINE RECEPTACLE
MH	MANHOLE
T	TELEPHONE RISER
	AREA LIGHT
CO	CLEAN OUT
NS	NOT SAMPLED
BDL	BELOW DETECTION LIMIT
J	ESTIMATED

SAMPLING DATE
ANALYTICAL RESULT (BENZENE)

NOTE:
1. ALL RESULTS IN µg/L
2. SHADED CONCENTRATIONS EXCEED THE 2L GWQS OF 1 µg/L
3. 1613-14 AND 1613-16 OMITTED FROM CONTOURING
4. 1995 DATA ADAPTED FROM CATLIN'S CAP
5. 2003 DATA ADAPTED FROM INFORMATION PROVIDED BY SHAW ENVIRONMENTAL, INC.

203063-1613-03FINAL-08

FIGURE 6

TITLE: LABORATORY ANALYTICAL RESULTS - GROUNDWATER - BENZENE - 1995 VS. 2003

SCALE: 1"=60' | DRAWN BY: HCS | CHECKED BY: JKB

PROJECT: BUILDING 1613 MARINE CORPS BASE CAMP LEJEUNE, NC

JOB NO. 203063 | DATE: DEC 2003

CATLIN ENGINEERS and SCIENTISTS
WILMINGTON, NORTH CAROLINA

1613-15
5/4/95 BDL | 6/21/03 NS

1613-8
5/4/95 BDL | 6/21/03 NS

1613-6
5/4/95 BDL | 6/21/03 2.5

HP-5
4/6/95 10.6

1613-1
5/4/95 BDL | 6/21/03 NS

1613-5
5/4/95 BDL | 6/21/03 NS

1613-17
5/4/95 NS | 6/21/03 NS

HPGW-6
6/21/03 443

1613-18
5/4/95 NS | 6/21/03 NS

HP-8
4/5/95 20,700

1613-19
5/4/95 NS | 6/21/03 NS

1613-11
5/4/95 4.3 | 6/21/03 4.4

1613-4
5/4/95 BDL | 6/21/03 NS

1613-14
5/4/95 BDL | 6/21/03 NS

1613-16
5/4/95 2.4 | 6/21/03 1.6

HP-11
4/6/95 10,800

1613-10
5/4/95 6,780 | 6/21/03 13.7

1613-22
6/21/03 2,060

1613-20
6/21/03 5.5

1613-21
6/21/03 21.8

HP-7
4/12/95 12.8

1613-9
5/4/95 BDL | 6/21/03 NS

HP-10
4/6/95 21.6

1613-3
5/4/95 BDL | 6/21/03 NS

1613-12
5/4/95 BDL | 6/21/03 NS

HP-12
4/5/95 14.4

HP-14
4/5/95 1.6

HP-15
4/5/95 44.9

1613-2
5/4/95 BDL | 6/21/03 NS

1613-13
5/4/95 BDL | 6/21/03 NS

1613-7
5/4/95 BDL | 6/21/03 NS

HPGW-5

HPGW-7

ESTIMATED HORIZONTAL EXTENT OF TOLUENE ABOVE THE 2L GWQS OF 1000 µg/L AS OF MAY 1995

ESTIMATED HORIZONTAL EXTENT OF TOLUENE ABOVE THE 2L GWQS OF 1000 µg/L AS OF JUNE 21, 2003

FREE PRODUCT RECOVERY SYSTEM

BUILDING 1613 GASOLINE SALES

BLDG 1615

BLDG 1614

BLDG 1611

BLDG 1612

BLDG 1610

BLDG 1500

DOMINO'S PIZZA

SEPTIC TANK

PAVED PARKING LOT

GRASS ISLAND

PUMP ISLANDS

CANOPY

GRASS

CONCRETE SIDEWALK

EDGE OF PAVEMENT

GUM STREET

FIR STREET

WEST STREET

18" WATERLINE

STEAM TUNNEL UNDER SIDEWALK

STEAM PIT

HEATING & AIR COND. UNIT

CONC. PAD

DUMPSTER

ELECTRIC OUTLET

GAS SIGN

GUY POLE

PI-5 PK NAIL

E-2 CONC. MONUMENT W/DISK

RAILROAD TRACK

60 30 0 60

SCALE IN FEET

LEGEND

EXISTING	DESCRIPTION
	BUILDING
⊕	TYPE II WELL
⊕	TYPE III WELL
	PUMPING WELL
⊕	HYDROPUNCH
△	SURVEY CONTROL POINT
	TREE
S	STEAM LINE
W	WATERLINE W/VALVE
PP	AERIAL POWER LINE W/POLE
UT	UNDERGROUND TELEPHONE
F	FUEL LINE
A	AIR LINE
C&G	CONCRETE CURB & GUTTER
GUY	GUY ANCHOR
FH	FIRE HYDRANT
	AIR LINE RECEPTACLE
MH	MANHOLE
T	TELEPHONE RISER
	AREA LIGHT
CO	CLEAN OUT
NS	NOT SAMPLED
BDL	BELOW DETECTION LIMIT

SAMPLING DATE
ANALYTICAL RESULT (TOLUENE)

NOTE:
1. ALL RESULTS IN µg/L
2. SHADED CONCENTRATIONS EXCEED THE 2L GWQS OF 1000 µg/L
3. 1613-14 AND 1613-16 OMITTED FROM CONTOURING
4. 1995 DATA ADAPTED FROM CATLIN'S CAP
5. 2003 DATA ADAPTED FROM INFORMATION PROVIDED BY SHAW ENVIRONMENTAL, INC.

203063-1613-GENRAL-07

FIGURE 7

TITLE: LABORATORY ANALYTICAL RESULTS - GROUNDWATER - TOLUENE - 1995 VS. 2003

SCALE: 1"=60' | DRAWN BY: HCS | CHECKED BY: JKB

PROJECT: BUILDING 1613 MARINE CORPS BASE CAMP LEJEUNE, NC

JOB NO. 203063 | DATE: DEC 2003

CATLIN ENGINEERING
WILMINGTON, NORTH CAROLINA

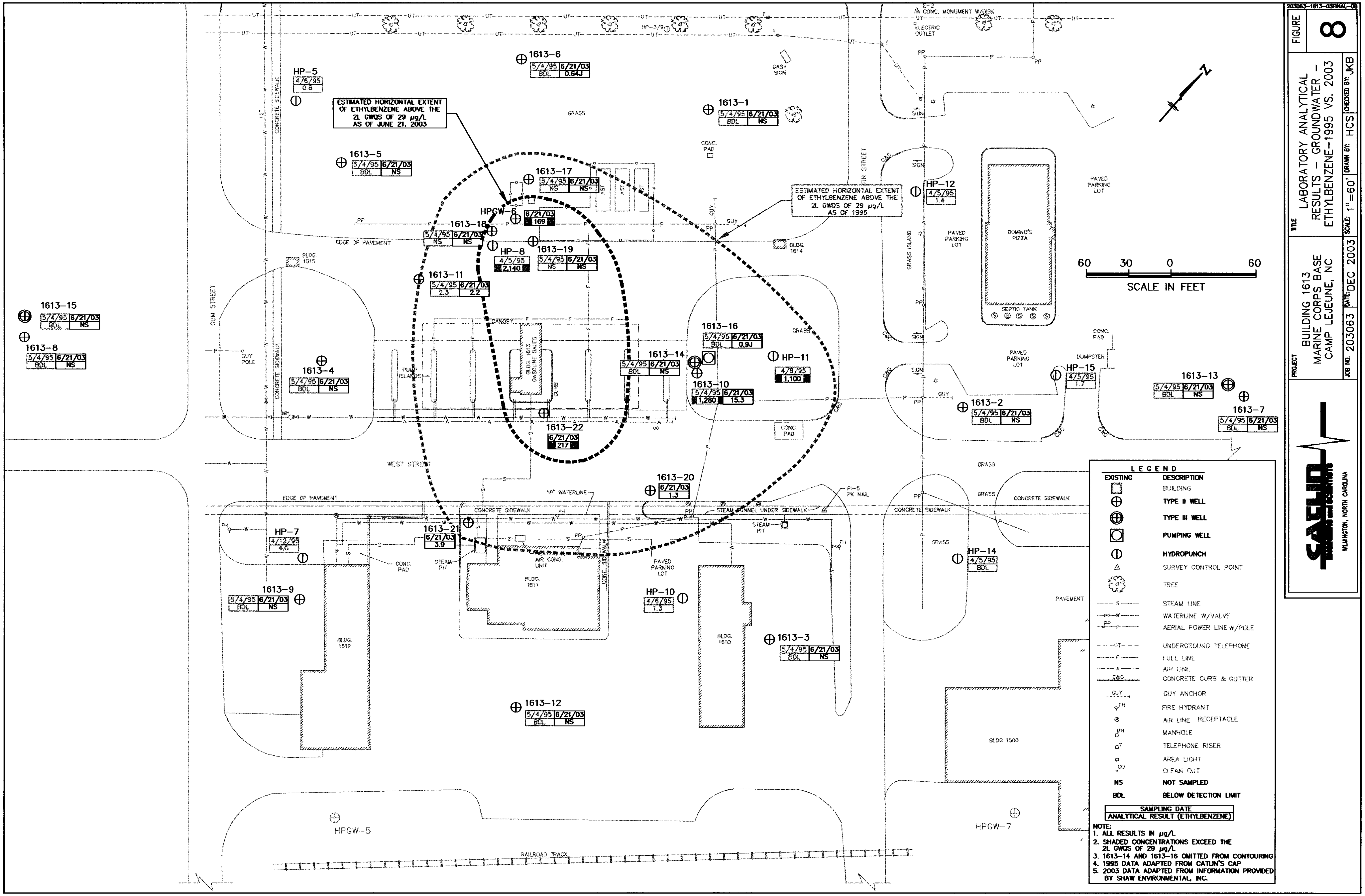


FIGURE 8
LABORATORY ANALYTICAL RESULTS – GROUNDWATER – ETHYLBENZENE–1995 VS. 2003
BUILDING 1613 MARINE CORPS BASE CAMP LEJEUNE, NC
SCALE: 1"=60' DRAWN BY: HCS CHECKED BY: JKB
JOB NO. 203063 DATE: DEC 2003
WILMINGTON, NORTH CAROLINA
203063-1613-03FINAL-08
ESTIMATED HORIZONTAL EXTENT OF ETHYLBENZENE ABOVE THE 2L GWQS OF 29 µg/L AS OF JUNE 21, 2003
ESTIMATED HORIZONTAL EXTENT OF ETHYLBENZENE ABOVE THE 2L GWQS OF 29 µg/L AS OF 1995
1613-6 5/4/95 BDL 6/21/03 0.64J
HP-5 4/6/95 0.8
1613-1 5/4/95 BDL 6/21/03 NS
1613-5 5/4/95 BDL 6/21/03 NS
1613-17 5/4/95 NS 6/21/03 NS
HPGW-6 6/21/03 169
1613-18 5/4/95 NS 6/21/03 NS
HP-8 4/5/95 2,140
1613-19 5/4/95 NS 6/21/03 NS
1613-11 5/4/95 2.3 6/21/03 2.2
HP-12 4/5/95 1.4
1613-15 5/4/95 BDL 6/21/03 NS
1613-8 5/4/95 BDL 6/21/03 NS
1613-4 5/4/95 BDL 6/21/03 NS
1613-16 5/4/95 BDL 6/21/03 0.9J
1613-14 5/4/95 BDL 6/21/03 NS
HP-11 4/6/95 1,100
1613-10 5/4/95 1,280 6/21/03 15.3
HP-15 4/5/95 1.7
1613-13 5/4/95 BDL 6/21/03 NS
1613-7 5/4/95 BDL 6/21/03 NS
1613-2 5/4/95 BDL 6/21/03 NS
1613-22 6/21/03 217
1613-20 6/21/03 1.3
HP-7 4/12/95 4.0
1613-21 6/21/03 3.9
HP-14 4/5/95 BDL
1613-9 5/4/95 BDL 6/21/03 NS
HP-10 4/6/95 1.3
1613-3 5/4/95 BDL 6/21/03 NS
1613-12 5/4/95 BDL 6/21/03 NS
HPGW-5
HPGW-7
GUM STREET
WEST STREET
FIR STREET
CONCRETE SIDEWALK
EDGE OF PAVEMENT
GRASS
BLDG. 1613 GASOLINE SALES
CANOPY
PUMP ISLANDS
BLDG. 1615
BLDG. 1614
BLDG. 1611
BLDG. 1612
BLDG. 1610
BLDG 1500
DOMINO'S PIZZA
SEPTIC TANK
PAVED PARKING LOT
STEAM TUNNEL UNDER SIDEWALK
18" WATERLINE
AIR COND. UNIT
STEAM PIT
CONC. PAD
DUMPSTER
RAILROAD TRACK
PAVEMENT
60 30 0 60
SCALE IN FEET
LEGEND
EXISTING DESCRIPTION
BUILDING
TYPE II WELL
TYPE III WELL
PUMPING WELL
HYDROPUNCH
SURVEY CONTROL POINT
TREE
STEAM LINE
WATERLINE W/VALVE
AERIAL POWER LINE W/POLE
UNDERGROUND TELEPHONE
FUEL LINE
AIR LINE
CONCRETE CURB & GUTTER
GUY ANCHOR
FIRE HYDRANT
AIR LINE RECEPTACLE
MANHOLE
TELEPHONE RISER
AREA LIGHT
CLEAN OUT
NS NOT SAMPLED
BDL BELOW DETECTION LIMIT
SAMPLING DATE
ANALYTICAL RESULT (ETHYLBENZENE)
NOTE:
1. ALL RESULTS IN µg/L
2. SHADED CONCENTRATIONS EXCEED THE 2L GWQS OF 29 µg/L
3. 1613-14 AND 1613-16 OMITTED FROM CONTOURING
4. 1995 DATA ADAPTED FROM CATLIN'S CAP
5. 2003 DATA ADAPTED FROM INFORMATION PROVIDED BY SHAW ENVIRONMENTAL, INC.

203063-1613-03FINAL-09

FIGURE 9

TITLE: LABORATORY ANALYTICAL RESULTS – GROUNDWATER – TOTAL XYLENES–1995 VS. 2003

SCALE: 1"=60' | DRAWN BY: HCS | CHECKED BY: JKB

PROJECT: BUILDING 1613 MARINE CORPS BASE CAMP LEJEUNE, NC

JOB NO. 203063 | DATE: DEC 2003

CATLIN ENGINEERING WILMINGTON, NORTH CAROLINA

ESTIMATED HORIZONTAL EXTENT OF TOTAL XYLENES ABOVE THE 2L GWQS OF 530 µg/L AS OF JUNE 21, 2003

ESTIMATED HORIZONTAL EXTENT OF TOTAL XYLENES ABOVE THE 2L GWQS OF 530 µg/L AS OF MAY 1995

HP-5 4/6/95 2.1

1613-6 5/4/95 BDL | 6/21/03 4.2

1613-1 5/4/95 BDL | 6/21/03 NS

1613-5 5/4/95 BDL | 6/21/03 NS

1613-17 5/4/95 NS | 6/21/03 NS

HPGW-6 6/21/03 1,310

1613-18 5/4/95 NS | 6/21/03 NS

HP-8 4/5/95 10,800

1613-19 5/4/95 NS | 6/21/03 NS

1613-11 5/4/95 18.9 | 6/21/03 17.7

HP-12 4/5/95 2.4

1613-15 5/4/95 BDL | 6/21/03 NS

1613-8 5/4/95 BDL | 6/21/03 NS

1613-4 5/4/95 BDL | 6/21/03 NS

1613-16 5/4/95 44.8 | 6/21/03 7.2

1613-14 5/4/95 BDL | 6/21/03 NS

HP-11 4/6/95 5,420

1613-10 5/4/95 9,290 | 6/21/03 102

HP-15 4/5/95 55.1

1613-13 5/4/95 BDL | 6/21/03 NS

1613-2 5/4/95 BDL | 6/21/03 NS

1613-7 5/4/95 BDL | 6/21/03 NS

1613-22 6/21/03 1,660

1613-20 6/21/03 9.4

HP-7 4/12/95 149

1613-21 6/21/03 21.8

HP-14 4/5/95 BDL

1613-9 5/4/95 BDL | 6/21/03 NS

HP-10 4/6/95 BDL

1613-3 5/4/95 BDL | 6/21/03 NS

1613-12 5/4/95 BDL | 6/21/03 NS

HPGW-5

HPGW-7

60 30 0 60

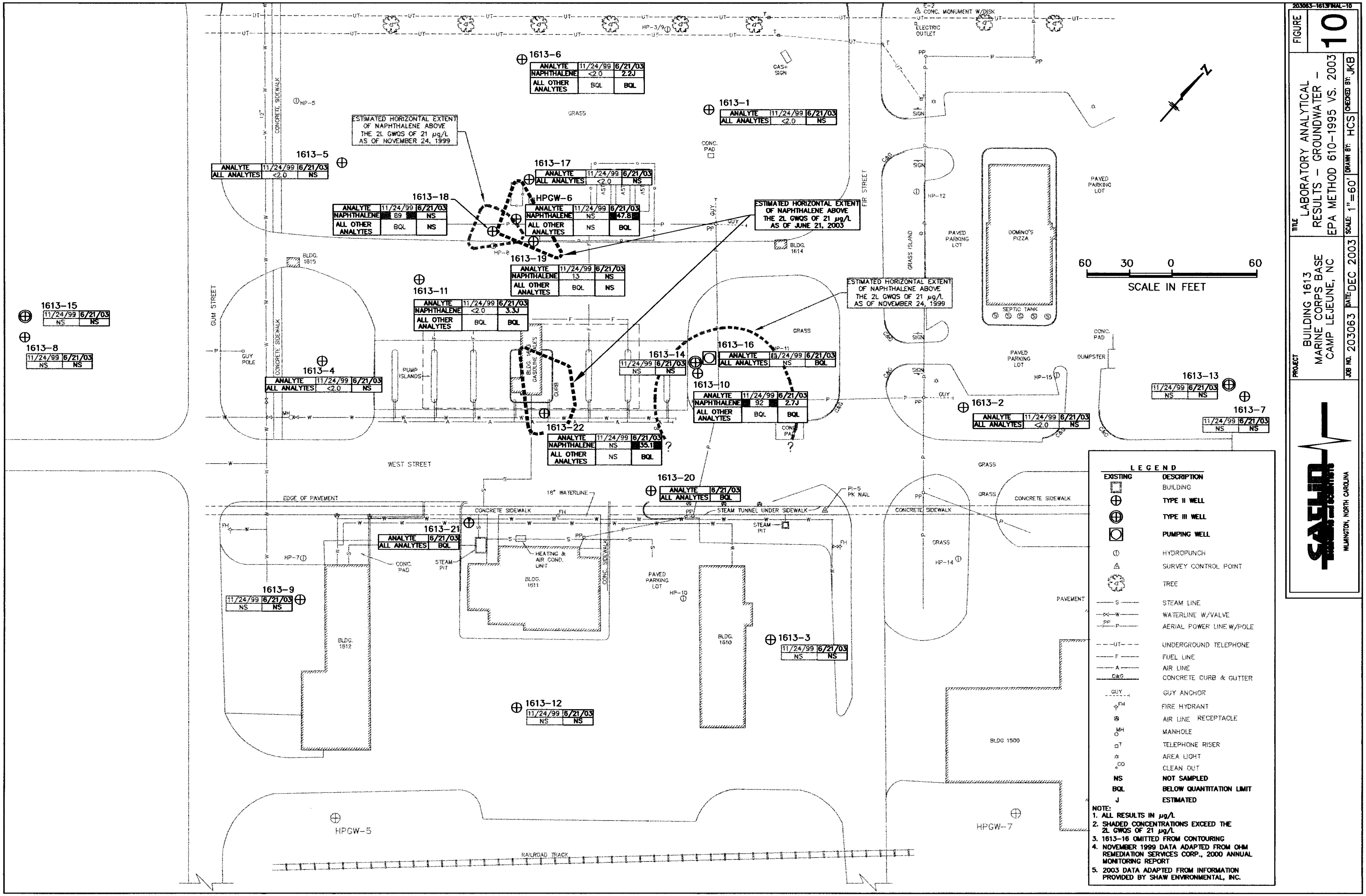
SCALE IN FEET

LEGEND

EXISTING	DESCRIPTION
	BUILDING
⊕	TYPE II WELL
⊕	TYPE III WELL
	PUMPING WELL
⊕	HYDROPUNCH
△	SURVEY CONTROL POINT
	TREE
S	STEAM LINE
W	WATERLINE W/VALVE
PP	AERIAL POWER LINE W/POLE
UT	UNDERGROUND TELEPHONE
F	FUEL LINE
A	AIR LINE
C&G	CONCRETE CURB & GUTTER
GUY	GUY ANCHOR
FH	FIRE HYDRANT
	AIR LINE RECEPTACLE
MH	MANHOLE
T	TELEPHONE RISER
	AREA LIGHT
CO	CLEAN OUT
NS	NOT SAMPLED
BDL	BELOW DETECTION LIMIT

SAMPLING DATE
ANALYTICAL RESULT (TOTAL XYLENES)

NOTE:
1. ALL RESULTS IN µg/L
2. SHADED CONCENTRATIONS EXCEED THE 2L GWQS OF 530 µg/L
3. 1613-14 AND 1613-16 OMITTED FROM CONTOURING
4. 1995 DATA ADAPTED FROM CATLIN'S CAP
5. 2003 DATA ADAPTED FROM INFORMATION PROVIDED BY SHAW ENVIRONMENTAL, INC.


1613-6
ANALYTE | 11/24/99 | 6/21/03
NAPHTHALENE | <2.0 | 2.2J
ALL OTHER ANALYTES | BQL | BQL
1613-1
ANALYTE | 11/24/99 | 6/21/03
ALL ANALYTES | <2.0 | NS
1613-5
ANALYTE | 11/24/99 | 6/21/03
ALL ANALYTES | <2.0 | NS
ESTIMATED HORIZONTAL EXTENT OF NAPHTHALENE ABOVE THE 2L GWQS OF 21 µg/L AS OF NOVEMBER 24, 1999
1613-17
ANALYTE | 11/24/99 | 6/21/03
ALL ANALYTES | <2.0 | NS
1613-18
ANALYTE | 11/24/99 | 6/21/03
NAPHTHALENE | 89 | NS
ALL OTHER ANALYTES | BQL | NS
HPGW-6
ANALYTE | 11/24/99 | 6/21/03
NAPHTHALENE | NS | 47.8
ALL OTHER ANALYTES | NS | BQL
ESTIMATED HORIZONTAL EXTENT OF NAPHTHALENE ABOVE THE 2L GWQS OF 21 µg/L AS OF JUNE 21, 2003
1613-19
ANALYTE | 11/24/99 | 6/21/03
NAPHTHALENE | 13 | NS
ALL OTHER ANALYTES | BQL | NS
1613-11
ANALYTE | 11/24/99 | 6/21/03
NAPHTHALENE | <2.0 | 3.3J
ALL OTHER ANALYTES | BQL | BQL
ESTIMATED HORIZONTAL EXTENT OF NAPHTHALENE ABOVE THE 2L GWQS OF 21 µg/L AS OF NOVEMBER 24, 1999
1613-15
11/24/99 | 6/21/03
NS | NS
1613-8
11/24/99 | 6/21/03
NS | NS
1613-4
ANALYTE | 11/24/99 | 6/21/03
ALL ANALYTES | <2.0 | NS
1613-14
11/24/99 | 6/21/03
NS | NS
1613-16
ANALYTE | 11/24/99 | 6/21/03
ALL ANALYTES | NS | BQL
1613-10
ANALYTE | 11/24/99 | 6/21/03
NAPHTHALENE | 92 | 2.7J
ALL OTHER ANALYTES | BQL | BQL
1613-13
11/24/99 | 6/21/03
NS | NS
1613-7
11/24/99 | 6/21/03
NS | NS
1613-2
ANALYTE | 11/24/99 | 6/21/03
ALL ANALYTES | <2.0 | NS
1613-22
ANALYTE | 11/24/99 | 6/21/03
NAPHTHALENE | NS | 35.1
ALL OTHER ANALYTES | NS | BQL
1613-20
ANALYTE | 6/21/03
ALL ANALYTES | BQL
1613-21
ANALYTE | 6/21/03
ALL ANALYTES | BQL
1613-9
11/24/99 | 6/21/03
NS | NS
1613-3
11/24/99 | 6/21/03
NS | NS
1613-12
11/24/99 | 6/21/03
NS | NS
HPGW-5
HPGW-7
GUM STREET
WEST STREET
FIR STREET
GRASS
CONCRETE SIDEWALK
PAVED PARKING LOT
DOMINO'S PIZZA
SEPTIC TANK
BLDG. 1615
BLDG. 1614
BLDG. 1611
BLDG. 1612
BLDG. 1610
BLDG 1500
PUMP ISLANDS
BLDG. 1613 GASOLINE SALES
STEAM TUNNEL UNDER SIDEWALK
18" WATERLINE
EDGE OF PAVEMENT
RAILROAD TRACK
PI-5 PK NAIL
60 30 0 60
SCALE IN FEET
LEGEND
EXISTING DESCRIPTION
BUILDING
TYPE II WELL
TYPE III WELL
PUMPING WELL
HYDROPUNCH
SURVEY CONTROL POINT
TREE
STEAM LINE
WATERLINE W/VALVE
AERIAL POWER LINE W/POLE
UNDERGROUND TELEPHONE
FUEL LINE
AIR LINE
CONCRETE CURB & GUTTER
GUY ANCHOR
FIRE HYDRANT
AIR LINE RECEPTACLE
MANHOLE
TELEPHONE RISER
AREA LIGHT
CLEAN OUT
NS NOT SAMPLED
BQL BELOW QUANTITATION LIMIT
J ESTIMATED
NOTE:
1. ALL RESULTS IN µg/L
2. SHADED CONCENTRATIONS EXCEED THE 2L GWQS OF 21 µg/L
3. 1613-16 OMITTED FROM CONTOURING
4. NOVEMBER 1999 DATA ADAPTED FROM OHM REMEDIATION SERVICES CORP., 2000 ANNUAL MONITORING REPORT
5. 2003 DATA ADAPTED FROM INFORMATION PROVIDED BY SHAW ENVIRONMENTAL, INC.
203063-1613FINAL-10
FIGURE 10
TITLE LABORATORY ANALYTICAL RESULTS - GROUNDWATER - EPA METHOD 610-1995 VS. 2003
PROJECT BUILDING 1613 MARINE CORPS BASE CAMP LEJEUNE, NC
JOB NO. 203063 DATE: DEC 2003 SCALE: 1"=60' DRAWN BY: HCS CHECKED BY: JKB
WILMINGTON, NORTH CAROLINA

APPENDIX A

TARGET CLEANUP CONCENTRATIONS FROM CAP

TABLE 3.1

SITE REHABILITATION GOALS

BUILDING 1613, USTs 1613-1-4
MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

ANALYTE	CURRENT MAXIMUM CONCENTRATION	TARGET CONCENTRATION (NORTH CAROLINA STATE STANDARDS)*
GROUND WATER		
Benzene	17,300 ppb	1 ppb
Toluene	20,700 ppb	1000 ppb
Ethylbenzene	2,140 ppb	29 ppb
Xylenes	10,800 ppb	530 ppb
Naphthalene	303 ppb	21 ppb

ppb parts per billion
* Goals of remediation are to achieve target concentrations or less.
NE Not Established

APPENDIX B

SUMMARY OF HISTORICAL SOIL LABORATORY RESULTS

TABLE 1.2 (Page 1 of 2)

SUMMARY OF LABORATORY ANALYTICAL RESULTS -- SOIL
TPH, FLASHPOINT, AND pH

BUILDING 1613, USTs 1613 1-4
MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

SAMPLE I.D.	SAMPLE DEPTH (ft)	LABORATORY RESULTS			
		TPH-5030 GASOLINE (mg/ Kg)	TPH-3550 DIESEL (mg/ Kg)	FLASHPOINT (Degree C)	pH
1613-1	2-4	BDL	BDL	NA	NA
	10-12	BDL	BDL	NA	NA
1613-2	2-4	BDL	BDL	>100	6.37
	10-12	BDL	BDL	NA	NA
1613-3	2-4	BDL	BDL	NA	NA
	10-12	BDL	BDL	NA	NA
1613-4	2-4	BDL	BDL	NA	NA
	10-12	BDL	BDL	NA	NA
1613-5	2-4	BDL	BDL	NA	NA
	10-12	BDL	BDL	NA	NA
1613-6	2-4	BDL	BDL	NA	NA
	10-12	BDL	BDL	NA	NA
1613-7	2-4	BDL	BDL	NA	NA
	10-12	BDL	BDL	NA	NA
1613-8	2-4	BQL	BDL	NA	NA
	10-12	BDL	BDL	NA	NA
1613-9	2-4	BDL	BDL	NA	NA
	10-12	BQL	BDL	NA	NA
1613-10	2-4	BDL	BDL	NA	NA
	10-12	BDL	BDL	NA	NA
1613-11	2-4	BDL	BDL	NA	NA
	10-12	BDL	BDL	NA	NA
NCDEHNR STANDARDS		10	40	N/ A	N/ A

NA = Not Analyzed
N/A = Not Applicable
BDL = Below Detection Limits

TABLE 1.2 (Page 2 of 2)

SUMMARY OF LABORATORY ANALYTICAL RESULTS -- SOIL
TPH, FLASHPOINT, AND pH

BUILDING 1613, USTs 1613 1-4
MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

SAMPLE I.D.	SAMPLE DEPTH (ft)	LABORATORY RESULTS			
		TPH-5030 GASOLINE (mg/ Kg)	TPH-3550 DIESEL (mg/ Kg)	FLASHPOINT (Degree C)	pH
1613-12	2-4	BDL	BDL	NA	NA
	10-12	BDL	BDL	NA	NA
1613-13	2.5-5.0	BDL	BDL	NA	NA
	37.5-40	BDL	BDL	NA	NA
1613-14	2-4	BDL	20.7	NA	NA
	37.5-40	BDL	BDL	NA	NA
1613-15	2.5-5	BDL	BDL	NA	NA
	37.5-40	BDL	BDL	NA	NA
1613-16	2-4	BDL	BDL	>130	8.43
	10-12	BDL	BDL	NA	NA
1613-SC (5/17/95)		BDL	BDL	NA	NA
LAB BLANK (4/19/95)		BDL	BDL	NA	NA
LAB BLANK (4/25/95)		BDL	BDL	NA	NA
NCDEHNR STANDARDS		10	40	N/ A	N/ A

NA = Not Analyzed
N/A = Not Applicable
BDL = Below Detection Limits

Table 1

Dispenser and Transfer Line
GRO and DRO Soil Analytical Results
Method 5030 and 3550(mg/kg)

SAMPLE NUMBER	SAMPLE DATE	DEPTH (in feet BLS)	GASOLINE RANGE ORGANICS (GRO)*	DIESEL RANGE ORGANICS (DRO)**
SB-001	9/20/00	3-4	<4.8	<9.6
SB-002	9/20/00	3-4	<4.7	14
SB-003	9/20/00	3-4	<5.2	<9.4
SB-004	9/20/00	3-4	<5.2	<9.6
SB-005	9/20/00	3-4	<4.6	<9.8
SB-006	9/20/00	3-4	<4.8	<9.7
SB-007	9/21/00	3-4	<5.3	<9.2
SB-008	9/21/00	3-4	<4.9	<9.4
SB-009	9/21/00	3-4	<5.8	<9.2
SB-010	9/21/00	3-4	<5.4	<9.4
SB-011	9/21/00	3-4	<5.3	<9.6
SB-012	9/21/00	3-4	5.69	10.4
SB-013	9/20/00	3-4	<5.3	37.3
SB-013 (duplicate)	9/20/00	3-4	<5.2	<9.2
SB-014	9/20/00	3-4	<5.2	<9.2
SB-015	9/20/00	3-4	<4.9	<9.4
SB-016	9/20/00	3-4	<5.9	<9.0
SB-017	9/21/00	3-4	<5.1	<9.8
SB-018	9/21/00	3-4	<5.2	<9.6
SB-019	9/21/00	3-4	<4.6	<9.6
SB-020	9/21/00	3-4	<4.6	<9.6
SB-021	9/21/00	3-4	<5.0	<9.7
SB-022	9/20/00	3-4	<4.7	<9.6
SB-023	9/21/00	3-4	**44.2**	**305**
SB-024	9/21/00	3-4	**28.9**	**179**
SB-025	9/21/00	3-4	<5.4	<9.2

Bold numbers indicate a concentration in excess of 15A NCAC 2L .0115 action levels

* Action Level for GRO = 10 mg/kg

** Action Level for DRO = 40 mg/kg

Table 2
Dispenser and Transfer Line
MADEP Soil and Results
VPH and EPH Methods (mg/kg)

		VOLATILE PETROLEUM HYDROCARBONS			EXTRACTABLE PETROLEUM HYDROCARBONS		
SAMPLE NUMBER	**LOCATION**	**C5-C8 Aliphatics**	**C9-C12 Aliphatics**	**C9-C10 Aromatics**	**C9-C18 Aliphatics**	**C19-C36 Aliphatics**	**C10-C22 Aromatics**
UST 1613-SB-026	1613-02	<0.11	0.31	0.33	<3.5	<4.7	11.0
UST 1613-SB-027	1613-23	<0.11	<0.02	<0.03	4.0	<4.4	9.3
UST 1613-SB-028	1613-24	<1.11	3.2	3.8	3.9	<4.4	12.0
UST 1613-SB-029	1613-24 Dup.	<1.11	3.0	3.9	5.1	<4.4	<9.4
Maximum Soil Contaminant Concentrations		72	3,255	34	9,386	93,860	206

All samples were collected on October 25, 2000

All samples were collected from a depth of three to four feet below land surface

The maximum soil contaminant concentrations are calculated using three different standards: residential, industrial/commercial, and soil-to-groundwater. The concentrations shown in this table are the most conservative (lowest concentration) of the three standards. For aliphatics in the C5-C8 and C9-C12 ranges, and for aromatics in the C9-C10 and C11C22 ranges, this was the soil-to-groundwater standard. For aliphatics in the C9-C18 and C19-C36 ranges, this was the residential standard.

APPENDIX C

SUMMARY OF HISTORICAL GROUNDWATER LABORATORY RESULTS (POST CAP)

Historical Data Obtained from Shaw's 2002 Annual Monitoring Report

CLJ - Building 1613
Project #920704

Analytical Data Summary

Well ID: HPGW-6

Event		2000-3	2001-2	2001-4	2002-2	2002-4
Date Sampled:		09/26/00	06/30/01	12/13/01	06/25/02	12/17/02
Analyte (ug/l)	Action Level	Result	Result	Result	Result	Result
EPA 601/602/624						
Benzene	1	370	430	[illegible]	53	2.4
1,2-Dichlorobenzene	620	<40	<250	<10	<20	<1.0
1,3-Dichlorobenzene	620	<40	<250	<10	<20	<1.0
1,4-Dichlorobenzene	75	<40	<250	<10	<20	<1.0
Ethylbenzene	29	836	430	241	961	19.5
Methylene chloride		N/A	N/A	N/A	<100	N/A
Toluene	1000	2040	3100	2460	669	62.1
Methyl tert-butyl ether	200	38.9 J	<200	15.8	<20	2.3
Xylenes (total)	530	4520	4800	2850	2360	412
Total BTEX		7166	8760	6144	3206.7	496
EPA 610						
Acenaphthene	80	<5.0	<1	<20	<20	<5.3
Acenaphthylene	210	<5.0	<1	<20	<20	<5.3
Anthracene	2100	<5.0	<1	<20	<20	<5.3
Benzo(a)anthracene	0.05	<5.0	<0.1	<20	<20	<5.3
Fluoranthene	250	<5.0	<0.2	<20	<20	<5.3
Fluorene	250	<5.0	0.8 J	<20	<20	<5.3
Naphthalene	21	113	43	39.9	60	15.5
Phenanthrene	210	<5.0	<1	<20	<20	<5.3
Pyrene	210	<5.0	<0.1	<20	<20	<5.3
Bold type indicates detectable concentrations.						
Shaded area indicates detectable concentrations above the groundwater quality standards.						

J= estimated
N/A= not analyzed

Printed: 1/22/2003
Samples analyzed by STL or Accutest

CLJ - Building 1613
Project #920704

Analytical Data Summary

Well ID: **1613-6**

Event:		1998-3	1999-1	1999-2	1999-3	1999-4	2000-2	2000-3S
Date Sampled:		9/28/98 & 10/09/98	03/05/99	05/21/99	08/10/99	11/21/99	05/22/00	09/24/00
Analyte (ug/l)	Action Level	Result	Result	Result	Result	Result	Result	Result
EPA 601/602/624								
Benzene	1	<1.0	1.4	1.1	1.1	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	620	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichlorobenzene	620	0.56 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,4-Dichlorobenzene	75	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	29	<1.0	2	5.6	<1.0	<1.0	<1.0	<1.0
Methylene chloride		0.62 J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Toluene	1000	<1.0	12	29	<1.0	<1.0	<1.0	<1.0
Methyl tert-butyl ether	200	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Xylenes (total)	530	<1.0	12	33	<1.0	<1.0	<1.0	<1.0
Total BTEX			27.9	71.6	1.1			
EPA 610								
Acenaphthene	80	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Acenaphthylene	210	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Anthracene	2100	0.55 J	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)anthracene	0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	280	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	280	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Naphthalene	21	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phenanthrene	210	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Pyrene	210	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
		Bold type indicates detectable concentrations.						
		Shaded text indicates detectable concentrations above the groundwater quality standards.						

J= estimated
N/A= not analyzed

Printed: 1/22/2003
Samples analyzed by STL or Accutest

CLJ - Building 1613
Project #920704

Analytical Data Summary
Well ID: **1613-6**

Event		2000-3A	2000-4	2001-2	2001-4	2002-2	2002-4
Date Sampled:		09/24/00	12/19/00	06/13/01	12/19/01	06/25/02	12/17/02
Analyte (ug/l)	Action Level	Result	Result	Result	Result	Result	Result
EPA 601/602/524							
Benzene	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	620	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichlorobenzene	620	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,4-Dichlorobenzene	75	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	29	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Methylene chloride		N/A	N/A	N/A	N/A	<5.0	N/A
Toluene	1000	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Methyl tert-butyl ether	200	<1.0	<5.0	<5.0	<1.0	<1.0	<1.0
Xylenes (total)	530	<3.0	<1.0	<1.0	<3.0	<3.0	<3.0
Total BTEX							
EPA 610							
Acenaphthene	90	<5.0	<2.0	<1.0	<5.0	<5.1	<5.2
Acenaphthylene	210	<5.0	<2.0	<1.0	<5.0	<5.1	<5.2
Anthracene	2100	<5.0	<2.0	<1.0	<5.0	<5.1	<5.2
Benzo(a)anthracene	0.05	<5.0	0.11	<0.1	<5.0	<5.1	<5.2
Fluoranthene	250	<5.0	<5.0	<0.2	<5.0	<5.1	<5.2
Fluorene	250	<5.0	<2.0	<2.0	<5.0	<5.1	<5.2
Naphthalene	21	<5.0	<2.0	<2.0	<5.0	<5.1	<5.2
Phenanthrene	210	<5.0	<1.0	<1.0	<5.0	<5.1	<5.2
Pyrene	210	<5.0	<0.5	<0.1	<5.0	<5.1	<5.2
		Bold type indicates detectable concentrations.					
		Shaded area indicates detectable concentrations above the groundwater quality standard.					

J= estimated
N/A= not analyzed

Printed 1/22/2003
Samples analyzed by STL or Accutest

CLJ - Building 1613
Project #920704

Analytical Data Summary

Well ID: **1613-10**

Event:		1998-3	1999-1	1999-2	1999-3	1999-4	2000-2	2000-3S
Date Sampled:		9/29/98 & 10/06/98	03/05/99	05/21/99	08/10/99	11/21/99	05/25/00	09/24/00
Analyte (ug/l)	Action Level	Result	Result	Result	Result	Result	Result	Result
EPA 601/602/624								
Benzene	1	89	420	340	220	<100	<80	<50
1,2-Dichlorobenzene	620	<1.0	<100	<100	<100	<100	<80	<50
1,3-Dichlorobenzene	620	0.22 J	<100	<100	<100	<100	<80	<50
1,4-Dichlorobenzene	75	<1.0	<100	<100	<100	<100	<80	<50
Ethylbenzene	29	26	750	620	510	240	270	<50
Methylene chloride		<2.0	<500	<500	<500	<500	<400	<250
Toluene	1000	19	4500	3100	3300	870	830	51
Methyl tert-butyl ether	200	<5.0	11400	14100	9300	7200	6600	1300
Xylenes (total)	530	168	5700	6980	5300	4500	2200	390
Total BTEX		214.9	11560	11160	9430	5710	3240	441
EPA 610								
Acenaphthene	90	<2.0	<20	<20	<20	<10	<2.0	<2.0
Acenaphthylene	210	<2.0	<20	<20	<20	<10	<2.0	<2.0
Anthracene	2100	0.55 J	<10	<10	<10	<5.0	<1.0	<1.0
Benzo(a)anthracene	0.05	<0.5	<1.0	<1.0	<1.0	<0.5	<0.1	<0.1
Fluoranthene	280	<0.5	<5.0	<5.0	<5.0	<2.5	<0.5	<0.5
Fluorene	280	<2.0	<20.0	<20.0	<20.0	<10.0	<2.0	<2.0
Naphthalene	21	<2.0	87	92	120	52	31	15
Phenanthrene	210	<1.0	<10	<10	<10	<5.0	<1.0	<1.0
Pyrene	210	<0.5	<5.0	<5.0	<5.0	<2.5	<0.5	<0.5
		Bold type indicates detectable concentrations.						
		Shaded area indicates detectable concentrations above the groundwater quality standards.						

J= estimated
N/A= not analyzed

Printed: 1/22/2003
Samples analyzed by STL or Accutest

CLJ - Building 1613
Project #920704

Analytical Data Summary

Well ID: 1613-10

Event:		2000-3A	2000-4	2001-2	2001-4	2002-2	2002-4
Date Sampled:		09/24/00	12/13/00	06/30/01	12/20/01	06/26/02	12/17/02
Analyte (ug/l)	Action Level	Result	Result	Result	Result	Result	Result
EPA 601/602/624							
Benzene	1	<25	<20	<50	<10	<20	<10
1,2-Dichlorobenzene	620	<25	<20	<50	<10	<20	<10
1,3 Dichlorobenzene	620	<25	<20	<50	<10	<20	<10
1,4-Dichlorobenzene	75	<25	<20	<50	<10	<20	<10
Ethylbenzene	29	124	91	<50	110	302	145
Methylene chloride		N/A	N/A	N/A	N/A	<100	N/A
Toluene	1000	47.2	270	82	154	652	169
Methyl tert-butyl ether	200	1400	2400	950	719	874	177
Xylenes (total)	530	424	1500	850	932	2280	983
Total BTEX		513.5	1861	932	1189	3254	1312
EPA 610							
Acenaphthene	20	<5.0	<2.0	<1.0	<20	<21	<20
Acenaphthylene	210	<5.0	<2.0	<1.0	<20	8.6 J	<20
Anthracene	2100	<5.0	<2.0	<1.0	<20	<21	<20
Benzo(a)anthracene	0.05	<5.0	<0.1	<0.1	<20	<21	<20
Fluoranthene	280	<5.0	<0.5	<0.2	<20	<21	<20
Fluorene	280	<5.0	<2.0	<2.0	<20	<21	<20
Naphthalene	21	4.6J	30	22	36.2	125	108
Phenanthrene	210	<5.0	<1.0	<1.0	<20	<21	<20
Pyrene	210	<5.0	<0.5	<0.1	<20	<21	<20
		Bold type indicates detectable concentrations.					
		Shaded area indicates detectable concentrations above the groundwater quality standards.					

J= estimated
N/A= not analyzed

Printed: 1/22/2003
Samples analyzed by STL or Accutest

CLJ - Building 1613
Project #920704

Analytical Data Summary

Well ID: 1613-11

Event:		1999-4	2000-3	2001-2	2001-4	2002-2	2002-4
Date Sampled:		11/2?/99	09/25/00	05/30/01	12/19/01	06/26/02	12/17/02
Analyte (ug/l)	Action Level	Result	Result	Result	Result	Result	Result
EPA 601/602/624							
Benzene	1	25	0.35 J	34	<1.0	39	<1.0
1,2-Dichlorobenzene	620	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichlorobenzene	620	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,4-Dichlorobenzene	75	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	29	9.9	<1.0	1.4	<1.0	0.93 J	<1.0
Methylene chloride		<10	N/A	N/A	N/A	<5.0	N/A
Toluene	1000	120	<1.0	17	<1.0	13.9	0.59 J
Methyl-tert-butyl ether	200	<10	2.4	<5.0	<1.0	1.1	<1.0
Xylenes (total)	530	200	<3.0	27	<3.0	12.3	<3.0
Total BTEX		351.9	0.85	48.4		31.03	0.59
EPA 610							
Acenaphthene	50	<2.0	<5.0	<1.0	<5.0	<5.0	<5.1
Acenaphthylene	210	<2.0	<5.0	<1.0	<5.0	<5.0	<5.1
Anthracene	2100	<1.0	<5.0	<1.0	<5.0	<5.0	<5.1
Benzo(a)anthracene	0.05	<0.1	<5.0	<0.1	<5.0	<5.0	<5.1
Fluoranthene	280	<0.5	<5.0	<0.2	<5.0	<5.0	<5.1
Fluorene	280	<2.0	<5.0	<2.0	<5.0	<5.0	<5.1
Naphthalene	21	<2.0	<5.0	<2.0	<5.0	<5.0	<5.1
Phenanthrene	210	<1.0	<5.0	<1.0	<5.0	<5.0	<5.1
Pyrene	210	<0.5	<5.0	<0.1	<5.0	<5.0	<5.1
Bold type indicates detectable concentrations.							
Shaded area indicates detectable concentrations outside the groundwater quality standards.							

J= estimated
N/A= not analyzed

Printed: 1/22/2003
Samples analyzed by STL or Accutest

CLJ - Building 1613
Project #920704

Analytical Data Summary
Well ID: **1613-16**

Event		2000-3	2001-2	2001-4	2002-2	2002-4
Date Sampled:		09/26/00	06/30/01	12/20/01	06/25/02	12/17/02
Analyte (ug/l)	Action Level	Result	Result	Result	Result	Result
EPA 601/602/624						
Benzene	1	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	620	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichlorobenzene	620	<1.0	<1.0	<1.0	<1.0	<1.0
1,4-Dichlorobenzene	75	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	29	<1.0	<1.0	<1.0	<1.0	6.7
Methylene chloride		N/A	N/A	N/A	<5.0	N/A
Toluene	1000	<1.0	1.7	<1.0	<1.0	6.2
Methyl tert-butyl ether	200	13.0	<5.0	<1.0	<1.0	<1.0
Xylenes (total)	530	<3.0	1.8	<3.0	<3.0	52.6
Total BTEX			3.5			65.5
EPA 610						
Acenaphthene	80	<5.0	<1.0	<5.0	<5.1	<5.2
Acenaphthylene	210	<5.0	<1.0	<5.0	<5.1	<5.2
Anthracene	2100	<5.0	<1.0	<5.0	<5.1	<5.2
Benzo(a)anthracene	0.05	<5.0	<0.1	<5.0	<5.1	<5.2
Fluoranthene	250	<5.0	<0.2	<5.0	<5.1	<5.2
Fluorene	250	<5.0	<2.0	<5.0	<5.1	<5.2
Naphthalene	21	<5.0	<2.0	<5.0	<5.1	2.6 J
Phenanthrene	210	<5.0	<1.0	<5.0	<5.1	<5.2
Pyrene	210	<5.0	<0.1	<5.0	<5.1	<5.2
Bold type indicates detectable concentrations.						
Shaded cells indicates detectable concentrations above the groundwater quality standards.						

J= estimated
N/A= not analyzed

Printed: 1/22/2003
Samples analyzed by STL or Accutest

CLJ - Building 1613
Project #920704

Analytical Data Summary

Well ID: **1613-20**

Event		2000-3	2001-2	2001-4	2002-2	2002-4
Date Sampled		09/25/00	06/30/01	12/19/01	06/25/02	12/17/02
Analyte (ug/l)	Action Level	Result	Result	Result	Result	Result
EPA 601/602/624						
Benzene	1	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	620	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichlorobenzene	320	<1.0	<1.0	<1.0	<1.0	<1.0
1,4-Dichlorobenzene	75	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	29	0.72 J	<1.0	<1.0	<1.0	<1.0
Methylene chloride		N/A	N/A	N/A	<5.0	N/A
Toluene	1000	2.7	6.2	<1.0	0.87 J	<1.0
Methyl tert-butyl ether	200	264	83	403	218	127
Xylenes (total)	530	9.4	12	<3.0	2.7 J	<3.0
Total BTEX		12.82	18.2		3.57	
EPA 610						
Acenaphthene	80	<5.0	<1.0	<5.0	<5.0	<5.1
Acenaphthylene	210	<5.0	<1.0	<5.0	<5.0	<5.1
Anthracene	2100	<5.0	<1.0	<5.0	<5.0	<5.1
Benzo(a)anthracene	0.05	<5.0	<0.1	<5.0	<5.0	<5.1
Fluoranthene	280	<5.0	<0.2	<5.0	<5.0	<5.1
Fluorene	280	<5.0	<2.0	<5.0	<5.0	<5.1
Naphthalene	21	<5.0	<2.0	<5.0	<5.0	<5.1
Phenanthrene	210	<5.0	<1.0	<5.0	<5.0	<5.1
Pyrene	210	<5.0	<0.1	<5.0	<5.0	<5.1
Bold type indicates detectable concentrations.						
Shaded area indicates detectable concentrations above the groundwater quality standards.						

J= estimated
N/A= not analyzed

Printed: 1/22/2003
Samples analyzed by STL or Accutest

CLJ - Building 1613
Project #920704

Analytical Data Summary

Well ID: **1613-21**

Event:		2000-3	2001-2	2001-4	2002-2	2002-4
Date Sampled:		09/26/00	06/30/01	12/10/01	06/25/02	12/17/02
Analyte (ug/l)	Action Level	Result	Result	Result	Result	Result
EPA 601/602/624						
Benzene	1	<1.0	1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	620	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichlorobenzene	620	<1.0	<1.0	<1.0	<1.0	<1.0
1,4-Dichlorobenzene	75	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	29	<1.0	<1.0	<1.0	<1.0	<1.0
Methylene chloride		N/A	N/A	N/A	<5.0	<5.0
Toluene	1000	0.64 J	9.4	<1.0	1.8	<1.0
Methyl tert-butyl ether	200	<1.0	<5.0	<1.0	<1.0	<1.0
Xylenes (total)	530	2.0 J	17	<3.0	4.7	<3.0
Total BTEX		2.64	27.4		6.5	
EPA 610						
Acenaphthene	90	<5.0	<1.0	<5.0	<5.0	<5.1
Acenaphthylene	210	<5.0	<1.0	<5.0	<5.0	<5.1
Anthracene	2100	<5.0	<1.0	<5.0	<5.0	<5.1
Benzo(a)anthracene	0.05	<5.0	<0.1	<5.0	<5.0	<5.1
Fluoranthene	280	<5.0	<0.2	<5.0	<5.0	<5.1
Fluorene	280	<5.0	<2.0	<5.0	<5.0	<5.1
Naphthalene	21	<5.0	<2.0	<5.0	<5.0	<5.1
Phenanthrene	210	<5.0	<1.0	<5.0	<5.0	<5.1
Pyrene	210	<5.0	<0.1	<5.0	<5.0	<5.1
Bold type indicates detectable concentrations.						
Shaded area indicates data table screen (results above the groundwater quality standards.						

J= estimated
N/A= not analyzed

Printed: 1/22/2003
Samples analyzed by STL or Accutest

CLJ - Building 1613
Project #920704

Analytical Data Summary

Well ID: **1613-22**

Event:		2000-3	2001-2	2001-4	2002-2	2002-4
Date Sampled:		09/25/00	05/30/01	12/2001	06/26/02	12/17/02
Analyte (ug/l)	Action Level	Result	Result	Result	Result	Result
EPA 601/602/624						
Benzene	1	3160	3700	538	430	31.2
1,2-Dichlorobenzene	620	<10.0	<100	<10	<10	<1.0
1,3-Dichlorobenzene	620	<10.0	<100	<10	<10	<1.0
1,4-Dichlorobenzene	75	<10.0	<100	<10	<10	<1.0
Ethylbenzene	29	551	<100	<10	341	2
Methylene chloride		N/A	N/A	N/A	<50	N/A
Toluene	1000	565	1300	376	1660	25.6
Methyl tert-butyl ether	200	424	240	284	289	62.6
Xylenes (total)	530	1070	520	111	526	13.3
Total BTEX		7446	3820	1026	2979.6	52.1
EPA 610						
Acenaphthene	80	<5.5	<1.0	<5.0	<20	<5.2
Acenaphthylene	210	<5.5	<1.0	<5.0	<20	<5.2
Anthracene	2100	<5.5	<1.0	<5.0	<20	<5.2
Benzo(a)anthracene	0.05	<5.5	<0.1	<5.0	<20	<5.2
Fluoranthene	280	<5.5	<0.2	<5.0	<20	<5.2
Fluorene	280	<5.5	<2.0	<5.0	<20	<5.2
Naphthalene	21	26.2	10	<5.0	22.3	<5.2
Phenanthrene	210	<5.5	<1.0	<5.0	<20	<5.2
Pyrene	210	<5.5	<0.1	<5.0	<20	<5.2
Bold type indicates detectable concentrations.						
Shaded area indicates detectable concentrations above the groundwater quality standards.						

J= estimated
N/A= not analyzed

Printed: 1/22/2003
Samples analyzed by STL or Accutest

2003 Data Provided by Shaw

CLJ - Building 1613
Project #824603

Analytical Data Summary

Sampling Event **June 2003 Organics**

Well ID:		**1613-11**	**1613-10**	**1613-6**	**1613-20**	**1613-21**	**HPGW6**	**1613-22**	**1613-16**
Laboratory Sample ID:		F18278-2	F18278-6	F18278-1	F18278-3	F18278-4	F18278-5	F18278-7	F18278-9
Date Sampled:		06/21/03	06/21/03	06/21/03	06/21/03	06/21/03	06/21/03	06/21/03	06/21/03
Analyte (ug/l)	**Action Level**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
EPA 624									
Benzene	1	**0.52 J**	**0.59 J**	<1.0	<1.0	**1.1**	**183**	**289**	<1.0
1,2-Dichlorobenzene	620	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichlorobenzene	620	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,4-Dichlorobenzene	75	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	29	**2.2**	**15.3**	**0.64 J**	**1.3**	**3.9**	**169**	**217**	**0.9 J**
Toluene	1000	**4.4**	**13.7**	**2.5**	**5.5**	**21.8**	**443**	**2060**	**1.6**
Methyl tert-butyl ether	200	<1.0	**5.2**	<1.0	**16.6**	<1.0	<1.0	**54.3**	<1.0
Xylenes (total)	530	**17.7**	**102**	**4.2**	**9.4**	**28.4**	**1310**	**1660**	**7.2**
Total BTEX		**24.82**	**131.59**	**7.34**	**16.2**	**55.2**	**2105**	**4226**	**9.7**
EPA 610									
Acenaphthene	80	<5.1	<5.0	<5.1	<5.0	<5.1	<5.1	<20	<5.1
Acenaphthylene	210	<5.1	<5.0	<5.1	<5.0	<5.1	<5.1	<20	<5.1
Anthracene	2100	<5.1	<5.0	<5.1	<5.0	<5.1	<5.1	<20	<5.1
Benzo(a)anthracene	0.05	<5.1	<5.0	<5.1	<5.0	<5.1	<5.1	<20	<5.1
Fluoranthene	280	<5.1	<5.0	<5.1	<5.0	<5.1	<5.1	<20	<5.1
Fluorene	280	<5.1	<5.0	<5.1	<5.0	<5.1	<5.1	<20	<5.1
Naphthalene	21	**3.3 J**	**2.7 J**	**2.2 J**	<5.0	<5.1	**47.6**	**35.1**	<5.1
Phenanthrene	210	<5.1	<5.0	<5.1	<5.0	<5.1	<5.1	<20	<5.1
Pyrene	210	<5.1	<5.0	<5.1	<5.0	<5.1	<5.1	<20	<5.1
Bold type indicates detectable concentrations.									
Shaded area indicates detectable concentrations above the groundwater quality standards.									

Printed: 11/3/2003
Samples analyzed by Accutest

APPENDIX D

RISK CLASSIFICATION
AND
LAND USE FORM

A. RISK CHARACTERIZATION

Submit the following questionnaire in its entirety. Answer all questions completely. Attach additional pages as needed to fully explain answers. Base answers/explanations on information known or required to be obtained during the Limited Site Assessment.

NOTE: *Source area means point of release from a UST system.*

Limited Site Assessment Risk Classification and Land Use Form

Part I - Groundwater/Surface Water/Vapor Impacts
High Risk

1. *Has the release contaminated any water supply well including any used for non-drinking purposes?* YES **NO**

   According to water supply well data provided by MCB Camp Lejeune, no water supply wells are located within 1,500 feet of the site.

2. *Is a water supply well used for drinking water located within 1,000 feet of the source area of the discharge or release?* YES **NO**

   According to water supply well data provided by MCB Camp Lejeune, there are no water supply wells located within 1,000 feet of the source area.

3. *Is a water supply well not used for drinking water (e.g., irrigation, washing cars, industrial cooling water, filling swimming pools) located within 250 feet of the source area of the release?* YES **NO**

   No wells were located within 250 feet of the site.

4. *Does groundwater within 500 feet of the source area of the release have the potential for future use (there is no other source of water supply other than the groundwater)?* YES **NO**

   No, there are an adequate number of additional wells installed on other portions of the base, which are used for water supply. The subject area is an industrial area and MCB Camp Lejeune has indicated water supply wells will not be installed in this area in the future.

5. *Do vapors from the release pose a threat of explosion because of accumulation of the vapors in a confined space or pose any other serious threat to public health, public safety or the environment?* YES **NO**
   If YES describe.

   There is no evidence to suggest an accumulation of vapors and no evidence of accumulations has been reported.

6. *Are there any other factors that would cause the discharge or release to pose an imminent danger to public health, public safety, or the environment?* YES **NO**
If YES describe.

No evidence provided suggests other factors that would cause imminent danger to public health, public safety or the environment.

Intermediate Risk

7. *Is a surface water body located within 500 feet of the source area of the discharge or release?* YES **NO**
*If **YES**, does the maximum groundwater contaminant concentration exceed the surface water quality standards and criteria found in 15A NCAC 2B.0200 by a factor of 10?* YES **NO**

No water bodies have been identified within 500 feet of the release.

8. *Is the source area of the discharge or release located within an approved or planned wellhead protection area as defined in 42 USC 300h-7(e)?* YES **NO**
If YES describe.

Wellhead protection areas defined by 42 USC 300h-7(e) have not, as of this report, been designed by NCDENR for MCB, Camp Lejeune. However, MCB Camp Lejeune has identified wellhead protection areas on the base. Based on the most recent Wellhead Protection Plan Update (2002) performed for MCB Camp Lejeune, the site is not located within a potential wellhead protection area.

9. *Is the release located in the Coastal Plain physiographic region as designated on a map entitled "Geology of North Carolina" published by the Department in 1985?* **YES** NO
If YES, is the source area of the release located in an area in which there is recharge to an unconfined or semi-confined deeper aquifer that is being used or may be used as a source of drinking water? YES **NO**
If YES describe.

Recharge to the lower portions of the aquifer does not appear to occur in the area. Additionally, groundwater samples collected from Type III monitoring wells at the site were found to be BDL for all parameters.

10. *Do the levels of groundwater contamination for any contaminant exceed the gross contamination levels established by the Department?* YES **NO**

As of June 21, 2003, no contaminants levels were above the GCL's.

Part II - Land Use

Property Containing Source Area of Release

The questions below pertain to the property containing the source area of the release.

1. *Does the property contain one or more primary or secondary residences (permanent or temporary)?* YES **NO**
Describe.

No, the property contains a gas station.

2. *Does the property contain a school, daycare center, hospital, playground, park, recreation area, church, nursing home, or other place of public assembly?* YES **NO**
Describe.

No place of public assembly exists.

3. *Does the property contain a commercial (e.g., retail, warehouse, office/business space, etc.) or industrial (e.g., manufacturing, utilities, industrial research and development, chemical/petroleum bulk storage, etc.) enterprise, an inactive commercial or industrial enterprise, or is the land undeveloped?* **YES** NO
Describe.

Yes, as previously mentioned, the property contains a gas station with 3 above ground storage tanks, of which 2 contain Regular Unleaded gasoline and 1 Premium Unleaded gasoline.

4. *Do children visit the property?* **YES** NO
Explain.

Yes, children visit the gas station facilities, which is not restricted by a fence. The remediation system and ASTs are restricted by a fence. All other areas are open to the public.

Is access to the property reliably restricted consistent with its use (e.g., by fences, security personnel or both)? YES **NO**
Explain.

No, the property is open to the public with the exception of the AST's and remediation system.

5. *Do pavement, buildings, or other structures cap the contaminated soil?* **YES** NO
Describe.

The contaminated soil areas indicated within the optimization plan are capped with pavement.

If YES, what mechanisms are in place or can be put into place to ensure that the contaminated soil will remain capped in the foreseeable future?

As necessary, appropriate land use restrictions will insure that any potentially impacted soils will remain in place.

6. *What is the zoning status of the property?*

The MCB, Camp Lejeune, is not subject to local or county zoning requirements, however, the subject site is located within an industrial area.

7. *Is the use of the property likely to change in the next 20 years?* YES **NO**
Explain.

No, the designated use of military property is not likely to change in the foreseeable future.

Property Surrounding Source Area of Release
The questions below pertain to the area within 1500 feet of the source area of the release (excludes property containing source area of the release):

1. *What is the distance from the source area of the release to the **nearest** primary or secondary residence (permanent or temporary)?*

   A hotel is located at approximately 700 feet northeast of the subject site on Holcomb Blvd. Base housing (multi-unit) is located at approximately 1,500 feet northwest of the subject site on Pitcher Road.

2. *What is the distance from the source area of the release to the **nearest** school, daycare center, hospital, playground, park, recreation area, church, nursing home or other place of public assembly?*

   Parade grounds are located at approximately 1,100 feet west of subject site. Athletic fields have been identified adjacent or possibly within the parade grounds. Athletic courts have been identified between 1,000 and 1,500 feet northwest of the subject site.

3. *What is the zoning status of properties in the surrounding area?*

   As previously mentioned, the MCB Camp Lejeune is not subject to local or county zoning requirements, however, the subject site is located in an industrial area.

4. *Briefly characterize the use and activities of the land in the surrounding area.*

   The site of release is surrounded by retail, service, and industrial industries that support the MCB Camp Lejeune.

B. RECEPTOR INFORMATION

1. Water Supply Wells
(see Table 5 and Figure 1)

Physical reconnaissance and review of the Wellhead Protection Plan – 2002 Update prepared by AH Environmental indicated that no water supply wells are located within 1,500 feet of the subject site.

2. Public Water Supplies

Are public water supplies available within 1,500 feet of the source area of the release? **YES** NO

If YES, where is the location of the nearest public water lines and the source(s) of the public water supply (indicate on map). Describe.

Public water is provided to buildings within 1,500 feet of the subject site by water mains which carry treated potable water. Potable water is supplied to the site and surrounding areas by the MCB water supply system. Potable water for Camp Lejeune is obtained from various water treatment facilities throughout the base. Groundwater obtained from the Castle Hayne Aquifer is the raw water source for the treatment facilities.

3. Surface Water

Identify all surface water bodies (e.g., ditch, pond, stream, lake, river) within 1,500 feet of the source area of the release. This information must be shown on the USGS topographic map.

Tributary of Beaverdam Creek lies approximately 1050 feet north of the subject site, and a pond was located approximately 1230 feet north of the site of release.

4. Wellhead Protection Areas

Identify all planned or approved wellhead protection areas (e.g., ditch, pond, stream, lake, river) within 1,500 feet of the source area of the release. This information must be shown on the USGS topographic map. Wellhead protection areas are defined in 42 USC 300h-7(e).

According to the Wellhead Protection Plan – 2002 Update prepared by AH Environmental Consultants, the site is not locate in, or within 1,500 feet of, a wellhead protection area

5. Deep Aquifers in the Coastal Plain Physiographic Region

(refer to page 19 of the guidelines) NOTE: This requirement only pertains to releases in the Coastal Plain physiographic region as designated on a map entitled "Geology of North Carolina" published by the Department in 1985.

As identified in the Geologic Map of North Carolina (North Carolina Department of Natural Resources and Community Development 1985), the subject site lies within the Coastal Plain physiographic province. Results of the groundwater analysis conducted on samples collected from the Type III monitoring wells indicates that the deeper portions of the aquifer have not been impacted by petroleum constituents.

To some degree seven of the ten aquifers identified to date in the North Carolina Coastal Plain are typically present beneath portions of the MCB Camp Lejeune. In order of increasing depth, these aquifers include the Surficial, Castle Hayne, Beaufort, Peedee, Black Creek, and upper and lower Cape Fear aquifers.

Aquifers below the surficial aquifer in the area typically include the Castle Hayne Aquifer, the Beaufort Aquifer, and the Peedee Aquifer, in order of increasing depth. Both the Beaufort and Peedee Aquifers contain saltwater in portions of the MCB Camp Lejeune and are not generally used for water supply. The Castle Hayne Aquifer contains freshwater and is the principal aquifer used in the area for water supply.

6. Subsurface Structures

Numerous underground utilities are present throughout the site. These utilities are located above the shallow groundwater table and are not considered potential receptors. Additionally, an active groundwater remediation system is currently in operation at the subject site.

7. Property Owners and Occupants

(see Table 6)

The subject site and surrounding area is owned and operated by the Commanding General- Marine Corps Base, Camp Lejeune.